SCIENTIFIC AMERICAN

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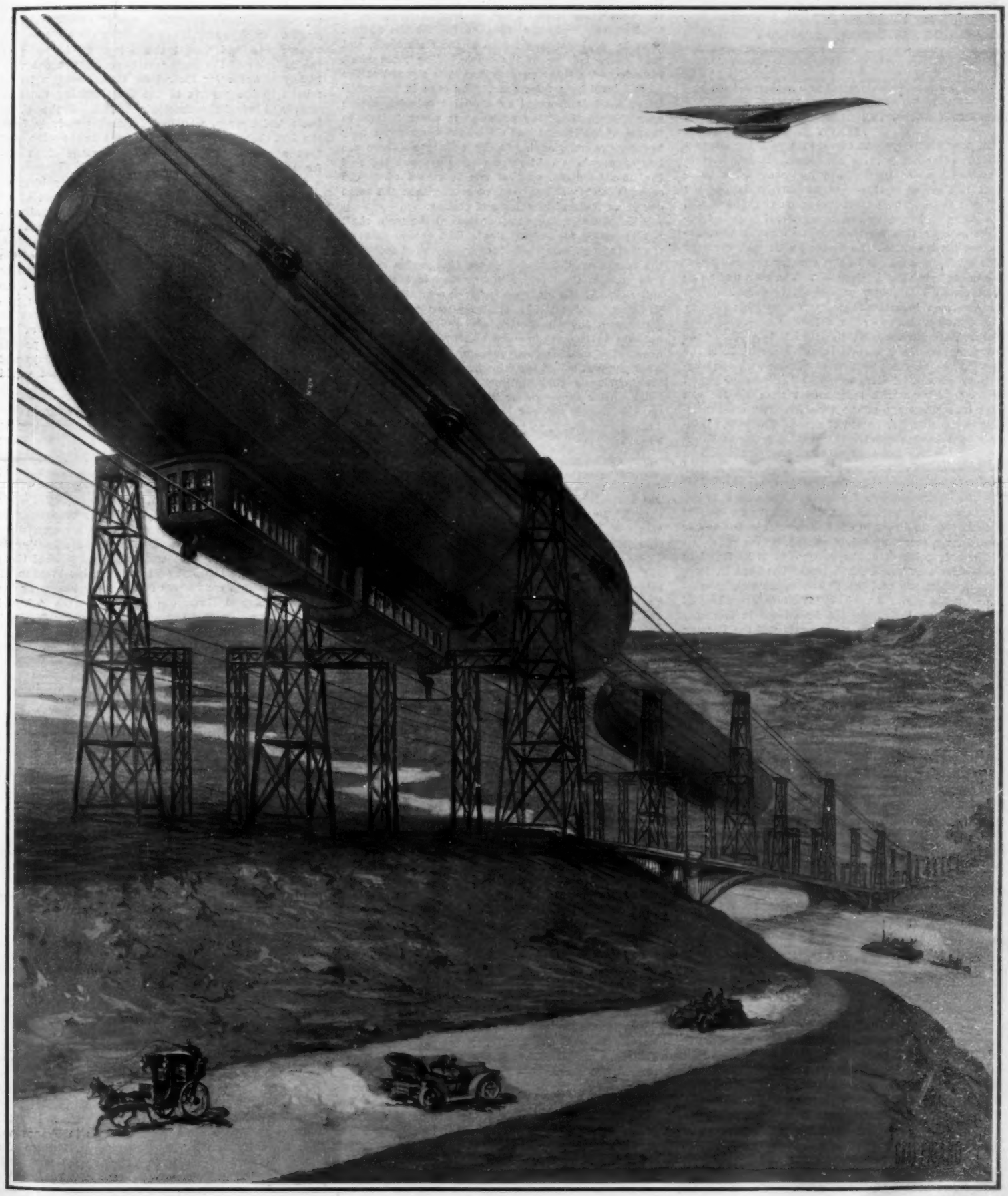

A ZEPPELIN RAILWAY.—[See page 411.]

SCIENTIFIC AMERICAN
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NEW YORK, SATURDAY, DECEMBER 4th, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A DECISION UNDER THE GERMAN-AMERICAN PATENT TREATY.

In nearly all European countries a patentee incurs a forfeiture for not working his patent within a certain statutory period. In Germany and some other countries this period is three years from the date of the patent's issue. The United States, on the other hand, has stimulated invention by more liberal laws and imposes no obligation whatever on the inventor to manufacture his invention. As a result a German inventor who takes out a patent in this country receives better treatment here than in Germany. The status of a foreign patentee is therefore difficult to define. When an American inventor discloses a secret, his country grants him a monopoly for a limited period as a reward. Once disclosed, all the world is informed of the invention, so that a certain injustice results from the fact that he may not be able to comply with the compulsory clauses of German and other foreign patent statutes. A man with more money than he has can thus take advantage of the situation after the expiration of the statutory period of grace. The only advantage to a foreign country in granting a patent on an invention which has been patented here is that we in our turn are willing to accord the same rights to citizens of that foreign country. It is therefore unfair for us to grant more to foreign inventors than American inventors receive abroad, particularly in view of the fact that no direct benefit is to be obtained from our award for a secret already disclosed.

The only solution of the problem is to be found in reciprocity treaties. Such a treaty has been in force between Germany and the United States since August 1st. By its terms American inventors are absolved from working their patented inventions in Germany within three years from the granting of the German patent. Heretofore failure to comply with this obligation would result in the loss of the German patent if an action for revocation were brought. The new treaty provides in effect that the working of a patent in the territory of one of the contracting parties shall be considered as equivalent to its working in the territory of the other party. Hence, an American citizen who works his United States patent in the United States will no longer be required to work his corresponding German patent in Germany in order to avoid forfeiture of his German patent. Moreover, since reciprocal rights are now granted by Germany, it would seem that an American inventor who takes out a patent in Germany ought to stand before a German court exactly as he would before an American court so far as forfeiture is concerned. In other words, since the United States does not compel him to work his patent, his German patent ought to be good whether he works his American patent or not.

A decision has just been handed down by the Imperial Supreme Court of Germany which construes the treaty from the German point of view and which is so liberal in its conclusion that the treaty may be regarded as retroactive in a measure, so as to apply to unexpired patents granted before the treaty became operative. The facts of the case are not all before us, but from what we may glean from press dispatches it would seem that the case involved the forfeiture of a patent which was taken out in Germany by the German branch of an American house before the treaty was signed and which was not worked within the statutory period of three years. An action brought to revoke the patent resulted in a forfeiture. The present decision, the result of an appeal, reverses the judgment of the lower tribunal, and holds that the patent was not forfeited. Before the decision was handed down by the higher court, the German branch had transferred its title to the American house, but whether this had any effect on the decision we are unable to state because the decision is not before us. Indeed, the status of the German branch is not at all clear. At all events, the decision is highly favorable to American inventors and places the German patents of American manufacturers on a most substantial footing.

THE CHERRY MINE DISASTER.

Now that the wave of newspaper frenzy has passed, there may be some of a scientific turn of mind who are anxious to know the real facts of the terrible disaster at the Cherry coal mine.

Two large veins in this mine, at three and five hundred foot levels, are good producers, levels known as the "second" and "third workings." The first is not worked. When the fire was discovered at or about 3 P.M. on Saturday, November 13th, there were upward of three hundred and fifty men in the mine, a force about equally divided between the second and third veins. Coal was being hoisted from the third to the second level by means of a cage in the ventilating shaft, which is located about three hundred feet from the main shaft. At the second level the coal was transferred to the main shaft, and from there hoisted to the tipple. The main shaft extends to the third working, but it is stopped at the second level by a false floor. The cage in the ventilating shaft is operated by a duplex cylinder engine near the mouth at the surface. It never travels to the top of the ground, and the engineer controls it only by pressure-bell signal. At the main shaft there are two cages whose cables are run to opposite sides of the hoisting drum, so that one is raised while the other is lowered. The men, of course, take the same course as the coal in going and coming.

Without doubt, the signal system at the main shaft is responsible for several lives. The engine room of the main hoist is located about one hundred feet from the mouth of the shaft. From the engine room a tube runs to the mine, with branches to each of the galleries. At the different landings a small air pump is located. The stroke of the piston in the pump compresses the air in the tube and causes a small hammer in the engine-room end to strike against a gong. The gong is rung once for each stroke of the hand pump at one of the mine landings. A man in the cage obviously cannot direct the movement of the hoist. After the engineer has been signaled to haul up, the men in the car can give no further signals. This arrangement was responsible for the loss of some life.

At the ventilating shaft there is located a large-capacity fan, which normally runs to deliver air down the shaft at a few ounces pressure. The foul air and gases are then forced up the main shaft in a strong breeze. In case of fire, it is customary to reverse this fan, in order that fire will not be pushed out into the main shaft, where the men are attempting to escape, and a signal is arranged to be given from the mine for such an emergency. In this particular mine, however, where the men must use both the ventilating shaft and the main shaft, the reversal of the fan simply cut off those seeking escape at the former in favor of those at the latter.

It is not known who gave the order to reverse the fan, but the signal came from the mine. The fire had been discovered in the mule barns on the second level between the two shafts, and men had begun to come up from the third level to the second, and to make their way over to the main shaft, to join those from the second level to be raised to the surface. The fan was blowing the fire toward the main shaft. The flames reached the dust-covered pine timbers of the structural work, when the reversal of the fan drew the flames toward the air shaft, thereby setting fire to the timbering there as well. Upon the reversal of the fan the main shaft was cleared for a time. Although the cages were bringing up miners on each trip, some four men decided to go down and assist the rest in getting to the shaft. This was a mistake; for, after the trip down, the would-be rescuers were as badly off as those whom they might have been able to save. After three or four trips down, and with the rescuers' cage at the bottom, the engineer received a bell to hoist away. He had started the cage upward when he received a signal to stop, then to lower, then to hoist, then to stop and lower. Finally there came a signal to stop. The engineer waited in vain for another bell, and after about fifteen minutes he was forced by threats to raise the cage. When it reached the surface, it was red hot and the men in it were all dead. The signal arrangement described was directly responsible for the loss of these lives. When the men in the cage were ready to be hoisted, one of their number had reached to the pump and given the necessary signal. The cage had then started upward, and had proceeded only a few feet when another miner, running toward the shaft, saw it and, reaching the signal on the landing, brought it back. After he had been taken on board and the cage again started upward, a second late arrival repeated the performance. By this time the fire had overtaken them, and rendered further signaling impossible. The cage should have been kept moving, but the engineer was bound by fixed rules and, moreover, had no way of knowing the conditions at the bottom of the shaft.

The only course left was to seal the shafts and smother the flames, which was done by means of steel rails, planks, and sand. On Sunday morning the seal was broken, and the fire found to be only smoldering. At this time it would probably have been feasible to have entered the mine, full of smoke as it was, with the assistance of oxygen helmets. Once down, it would have been a simple task to have quenched the fire with a good stream of water. Instead, the fan was foolishly started, with the idea of clearing the mine of smoke and gas. Common sense could have foreseen but one result. The mine was quickly in flames again, and the hope of saving any of the men who might still be alive was given up.

On Thursday several descents were made by way of the ventilating shaft, but the mine remained practically sealed until Friday, when the first bodies were taken out. Gases or "black damp" offered few obstacles. On Saturday, one week after the accident, the miners who had walled themselves up in some of the galleries of the second vein were taken out very little the worse for their long confinement, a living rebuke to the experts of the State Mining Commission, and of the technologic branch of the U. S. Geological Survey, who had declared positively from the first that there were no live men in the mine, and that a day or two more or less made little difference.

As a result of the Cherry disaster, the subject of safeguards for mines will receive a great deal of attention. It seems many improvements in general mining practice can be made if the lessons taught at Cherry are well learned.

We would make the suggestion that several of the worked-out chambers in each level of a coal mine be fitted up with supplies, food, and water, to last some length of time; that airtight doors of steel be provided; and that pipes from the air compressors on the surface be led to these rooms by way of the shafts. A small amount of air under a few pounds pressure would serve to keep men alive for days and weeks. The expense of such an arrangement would be little.

HIGH AND CROSS-COUNTRY FLYING ABROAD.

Since the daring high flights of Orville Wright at Potsdam and of Count de Lambert above the Eiffel Tower at Paris (which was also made with a Wright biplane), the other foreign aviators have been striving to outdo these feats of high and cross-country flying. At the aviation meetings in England recently, army officers made determinations with their theodolites of the height reached, this being the first occasion when the altitude of an aeroplane has been officially observed in this way. The greatest height reached there was 720 feet, attained by Paulhan on his Farman biplane; but this record was considerably beaten by the same aviator at Mourmelon, France, on the 19th and 20th ultimo. On the first of these two days, M. Paulhan, in a 10-minute flight in a wind said to be of 20 miles an hour velocity, rose to a height of 369 meters (1,210 feet), while Latham, on his bird-like "Antoinette" monoplane, reached 410 meters (1,345 feet), thus making a new height record for a single-surface aeroplane. Not to be outdone by his rival, however, Paulhan the next day made a new official record of 500 meters (1,640 feet), thus duplicating the height reached unofficially by Orville Wright at Potsdam. Besides this, he made a 55-minute flight from Mourmelon to Chalons and back, a distance of about 37 miles, in 55 minutes, or at an average speed of 40 miles an hour. In this flight he attained a height of nearly 1,000 feet, and at its termination glided to earth with his motor stopped from a height of about 700 feet. This method of descent, which is that usually followed by Paulhan, is far less dangerous than was that employed by Orville Wright at Potsdam, when he descended at a terrific speed in one-third the time it took him to ascend, and with his motor throttled only slightly, owing to his inability to throttle it down completely. He did not stop the motor, owing to his fear of alighting upon women or children (who were liable to run out and let the aeroplane fly over them) in case his machine was not completely under control.

Although Latham has not yet beaten Paulhan's record for height, he nevertheless made a sensational cross-country flight on November 23rd from Chalons to Berru, in order to attend a hunting party. At the appointed hour the monoplane appeared like a swift bird in the sky, circled twice around the field, and alighted in front of the hunting lodge. Latham, gun in hand, jumped out of his machine. After a successful hunt, he returned to Chalons in the monoplane. In addition to these two cross-country flights in France and his flight across Berlin last September, Latham also holds the record for flight in a strong wind as a result of his daring performance at Blackpool, England, on October 22nd, when he flew twice around the course in 10¼ minutes in a strong gusty wind which, according to the registration of a recording anemometer, had a velocity at times as high as 30 miles an hour.

ENGINEERING.

The Quebec Bridge Board of Engineers has called for bids for the removal of the wreckage of the old bridge and building the new substructure.

The Roosevelt dam on the Salt River project of the United States Reclamation Service in Arizona, at the end of September lacked only fifteen per cent of completion.

What is said to be the largest belt in the world has just been completed. It is 240 feet long and 6 feet wide; it has three-ply thickness, and the cost was $5,800; 540 hides were used in the construction.

In round numbers there are 1,250 street and interurban railway companies in America, with a total of 35,000 miles of single track and 75,000 passenger cars. The total number of passengers carried annually is 10,000,000,000, and the gross annual income is $440,000,000.

The monthly report of the passenger-train performance on the New York steam railways for August last shows that 65,312 trains were operated, of which 87 per cent were on time at the division terminals, as against 62,397, or 78 per cent, which were on time in August, 1908.

Continued rains throughout the Isthmus of Panama has resulted in two slides, which occurred in the Culebra cut. The occupants of the houses near by have been removed to safer quarters. The Chagres River has flooded large tracts, and in a number of places the railroad is under water.

The French War Office has recently acquired an automobile which is capable of being instantly changed from a land to a water machine. It has a speed of 40 kilometers on land, and 12 kilometers while in the water. It can carry four persons, and is actuated by a 14-horse-power motor.

In an address before the American Civic Association, Mr. Herbert M. Wilson, chief engineer in the United States Geological Survey, places the annual damage and waste by smoke in the United States at $500,000,000 in the large cities alone, or about $6 to each man, woman, and child of the population.

A gasoline car is being given a trial on the road leading to the estate of the late Mr. Harriman at Arden. The experiment is considered an important one, and it is thought results will prove that the gasoline-propelled car can be used as economically as one propelled by steam on short branches.

Suit was begun in Pittsburg on November 16th by the Krupp steel-manufacturing interests against an American steel-manufacturing concern for infringement of certain patent rights involving the manufacture of armor plate. The testimony relative to the patents used by the defendant concern was given behind closed doors.

The first boats built especially for the 1,000-ton barge canal arrived in New York a short time ago. They consist of a steam-power boat and five barges. They brought down on their first trip a cargo of 83,000 bushels of oats. At present there are only 2,000 canal boats of all sizes in New York State, and of these only 400 are of the first class; even these are rapidly wearing out.

A curious test was recently made on a manganese-steel bank safe by experts. The safe withstood fifteen charges of nitro-glycerine. The explosion of the last charge threw the safe over backward, and blew off the outer layer of the door. It was found that the inner part of the door, however, was but little affected. Unless some more effective method can be tried for opening safes of this type, they may be considered for the time being to be burglar-proof.

An article in Le Génie Civil states that seventy-eight electric furnaces now exist in the steel works of the world, of which thirty-five are on the induction and forty-three on the arc principle. Fourteen are Kjellin furnaces, eleven Stassano, ten Röchling-Rodenhauser, three Elecktrometall Society (Sweden), and one each Colby, Hiorth, Keller, Schneider, and Wallin. There is a steady and marked tendency to increase the capacity of these furnaces, some of those already constructed holding as much as eight to ten tons.

The first regular passenger train through the Pennsylvania Railroad tunnels from Harrison, N. J., under the North River, across Manhattan Island, and under the East River to Long Island City, made the trip on November 18th. This announced the practical completion of one of the most important achievements in American railroading. As the tunnels have not been electrified as yet, the train was pushed through the tunnels by a locomotive. The train was filled with officials, and time was allowed to thoroughly inspect the work, which will have cost nearly $160,000,000 by the time all is completed. All the tunnels will not be open to the traveling public for several months to come. It is probable that the section between the Manhattan station and Long Island will be open to the public by March 1st next, and that the whole tunnel will be open by June, 1910.

ELECTRICITY.

The Chicago City Council has recently passed an ordinance requiring that in cases of a delay of over ten minutes on surface or elevated lines, fares must be refunded to the passengers.

Our Vice Consul General in Calcutta calls attention to the opportunities in India for the sale of small electrical installations in country places. He describes a small plant consisting of a dynamo driven by an oil engine and a storage battery, which is arranged to operate thirty lights and eight electric fans. He urges American electric companies to investigate the subject, as there is a large opening for such installations.

The Spiez-Frutigen section of the Bernese Alpine Railway is about to be electrified. The power will be obtained from a pair of turbo-generators at Spiez, generating 6,400 horse-power at 15,000 volts. The line will be provided with two locomotives and three motor cars, each car weighing 55 metric tons. The motor cars will be required to take a load of 240 tons up a grade of 1.55 per cent, or a load of 160 tons up a 2.7 grade at about 30 miles an hour.

A very convenient device for cleaning incandescent lamp globes that are out of reach has recently been put on the market. It consists of a pole provided with a pair of rubber-covered jaws, which may be closed onto the lamp by pulling a cord. The lamp globe may then be unscrewed from its socket. The jaws remain closed until a second cord has been pulled. In cases where the lamps do not project vertically downward the device is applied to a pole, which is jointed so that the jaws may be inclined to fit over the lamp.

Central Park, New York, is to be illuminated with 1,477 electric lamps in place of the 400 gasoline lamps now in use. Three reasons have been given for this change. In the first place, the park is insufficiently illuminated at present; secondly, the use of gasoline has resulted in the destruction of grass around each lamp post, due to dripping or leakage; and finally, the lamplighters have worn paths across the turf from one lamp to another. The use of electricity will not require unsightly overhead wires, as the circuits will be contained in armored cables placed underground.

The introduction of tungsten lamps is doing much to advance the use of electricity on farms. It is possible for the farmer with a small plant, driven either by a gasoline engine or by damming a small stream, to obtain sufficient current to light his house and barn with this economical type of incandescent lamp. The use of electricity on the farm, by the way, is growing and, as pointed out by the Electrical World, farmers will in time come to consider electricity a necessity. Then it will be found profitable to establish central generating stations for farming districts to take the place of the small individual plants now being installed.

Experiments have been made in Switzerland showing that the higher altitudes provide exceptionally favorable locations for wireless telegraph receiving stations. Messages coming from points within a radius of two thousand miles have readily been picked up in the Alps. This is probably due to the fact that there are few intervening objects between these elevations and the sending stations which would be apt to interfere with the Hertzian waves. It has always been difficult to send messages across the Alps, or even from one part of Switzerland to another over the high altitudes, for the reason that the mountains absorb much of the energy.

Action has not yet been taken by the Chicago City Council on the question of enforcing the electrification of Chicago's railroad terminals. The employees of the railroad are raising objections to the proposed ordinance. They point to the fact that electrification would increase the danger to railroad men, particularly in the freight yards, claiming that it would be impossible to switch cars without having men standing on the car roofs, and here they would be liable to come in contact with sagging trolley wires; while if the third-rail system were used it would always be a source of danger, even though protected. One of their principal objections, however, is that they would be in danger of losing their positions.

According to an article in Harper's Weekly, one cent's worth of electricity will make four cups of coffee, or cook a steak, or boil two quarts of water, or make a Welsh rarebit, or operate a 7-inch frying pan for twelve minutes, or an electric griddle for eight minutes, or an electric broiler for six minutes, or run a sewing machine for three hours, or an electric flat-iron for fifteen minutes, or a luminous radiator for eight minutes, or a heating pad for two hours, or a foot warmer for fifteen minutes, or a massage machine for four hours, or a curling iron once a day for two weeks, or a dentist's drill for an hour and a half, or an electric piano player for an hour, or vulcanize a patch on an automobile tire, or keep a big glue pot hot for an hour, or brand electrically 150 hams, or raise a passenger elevator five stories a minute, or raise 250 gallons of water 100 feet high, or raise ten tons 12 feet high in less than one minute.

SCIENCE.

King Victor Emmanuel recently visited the Baths of Diocletian, which it is proposed to isolate and restore on the occasion of the celebration of the fiftieth anniversary of the proclamation of United Italy. The king has approved the project to repristinate the plan of Michael Angelo, who adapted the ancient ruins to the present church instead of building a new façade, as was originally intended. Thus the ruins will remain untouched. The sum of $160,000 has been provided to meet the expense of the necessary work.

The Duke of the Abruzzi has presented the "Stella Polare," the whaler which he purchased for the expedition to Franz Josef's Land, to the Ricreatorio Navale di Roma, an institution founded by the Naval League with the object of training young men both for the merchant marine and the royal navy. The "Stella Polare," which is at present at Spezia, soon will be brought up the Tiber to Rome and will be anchored off the port of Ripagrande, where it will be used for training students of the Ricreatorio.

A physician who has made a careful study of the effects of roller skating has shown that excessive indulgence in this sport frequently results in flat feet, defective development of the leg muscles, and impairment of the gait and carriage of the body. Roller skating is especially injurious to growing children, whose muscles, bones, and joints are still in process of development. The muscles used in walking, especially those of the feet, remain inactive in roller skating, while other muscles are overworked. Hence the body becomes more or less deformed, especially in the case of young girls, who fail to acquire their normal grace and beauty of form.

The American Museum of Natural History has acquired about two-thirds of a skeleton of a ceratopsian, a newly discovered species of which the triceratops or dinosaur is a member. The skeleton's size is about the same as the triceratops, which it resembles generally. The discovery of this remarkable prehistoric animal was made by Barnum Brown of the museum staff, who has just returned with an expedition from Montana. The Laramie formation in which the skeleton was found is estimated at 3,000,000 years. This species of dinosaur was an herb eater and walked on four feet. Its measurements, if it is the same as a triceratops, should be about twenty-three feet long and about seven feet wide.

Within the next few months radium will be manufactured in London. Hitherto the world has had to depend upon Continental laboratories for its radium. The new factory has been constructed according to the requirements of Sir William Ramsay, who has devised a method of radium extraction which will, it is claimed, enormously reduce the time now needed for the elimination of the non-radio-active elements of pitchblende. The more elementary properties of radium in the domain of medicine are becoming fairly well known, and hopes are not yet abandoned that by its immediate means one at least of the great and fast-growing curses of modern life may ultimately be arrested. It is, in the first instance, for therapeutic purposes that the new English manufactory is now being built.

Lendenfeld has made moving pictures of the flight of insects, with exposures of 1/42,000 second. Cranz has made a kinematographic study of the action of weapons and projectiles, employing for illumination electric sparks of a duration of one ten-millionth of a second, and obtaining pictures of 400 successive phases of the operation of the firing mechanism of an automatic pistol, although the entire operation occupied only about one-tenth of a second. On the other hand, Kohler has made a series of Roentgen ray photographs of the movements of respiration, the time of exposure of each photograph being 15 seconds, during which the breath was held. The photographs, after suitable reduction, were joined together in a continuous strip, which when used in connection with a kinematographic projecting apparatus, gave a moving picture of the respiratory process.

About two years ago Rutherford discovered that charcoal made from cocoanuts possesses the property of absorbing at ordinary temperature and retaining for a long time the gaseous emanations of radium, thorium, and actinium. Dr. Shober of Philadelphia has attempted to make practical use of this property for medical purposes, especially for the internal application of radio-activity. Attempts to use water as a vehicle of the emanation had failed, because water loses its radio-activity very rapidly. The experiments with cocoanut charcoal have given very satisfactory results, both qualitatively and quantitatively. The charcoal is entirely neutral and permanent, and can be administered internally with perfect safety. It can be made very easily and cheaply, has 200 or 300 times the radio-active absorptive capacity of water, and retains its activity for at least two weeks. The administration of the new preparation is very convenient and affords the possibility of producing, in equal or greater degree, all the effects of radio-active spring water.

AN ELECTRICAL HOUSEHOLD.

BY JACQUES BOYER.

The house which has just been fitted up in the heart of Paris by M. George Knap, of Troyes, is the last and most perfect illustration of modern comfort; and although a household of this character is not within the reach of everyone, its originality well merits description.

After having opened the door, by pressing a button, and confided to the telephone the object of our visit, we are conducted to the dining room. If a meal is being served, we are surprised to see no waiter moving around the room. The servants remain in the kitchen, and send up every dish at the proper moment. In the dining room is a switchboard with electrical measuring instruments and the necessary keys and commutators. The function of each key is inscribed above it, in order to diminish the chance of error, and a large bipolar commutator allows the switchboard to be cut off from the illuminating circuit. Various combinations of lights can be used according to circumstances. A large ornamental piece and dishes of fruit adorn the central part of the table, which is strewn with roses in which tiny electric bulbs are concealed. This central portion is surrounded by an oval groove, which leads to the two silver-plated doors which cover the entrance to the electric elevator. The area devoted to the plates and other utensils of the guests is bounded by low parapets of glass and silver. Below the table nothing appears except two nickel-plated bars which serve to guide the elevator, which is placed in the basement directly under the dining room. One of these bars supports the mechanism which operates the elevator and the crescent-shaped doors above it. On the table, beside the host, are four push buttons. When all the guests are seated, the host presses the white button, which causes a little drum to beat in the kitchen. Immediately the doors of the elevator shaft open, the soup tureen ascends to the table, and the doors close and conceal the opening. By pressing a red button at the right or left, the dish is caused to travel around the table in the corresponding direction. It is arrested at any point by removing the finger from the button. Other dishes are served in the same manner. The function of the fourth button is to cause the dish to rotate, in order to assist the guest in helping himself. When the course has been thus served, the dish is brought back to the elevator by the operation of the buttons, and the drum in the kitchen is caused to strike twice. Immediately the elevator doors open, and the elevator descends to the kitchen, whence it returns with the next course, after the plates have been changed.

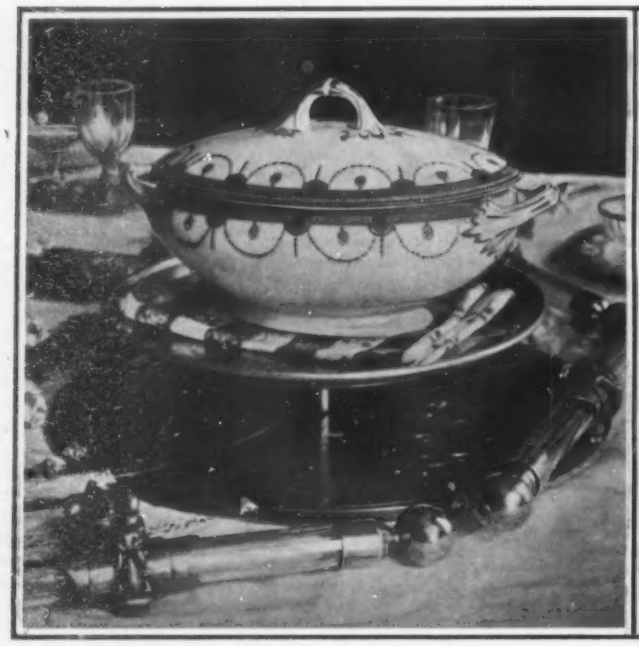
Let us now take a look at the clean and neatly-furnished kitchen. The electric range is incased in wood and marble, so that it resembles a buffet. Attached to it are a switchboard, an electric clock, a rheostat by which the strength of the current and the heating effect are varied, and an ammeter which measures the current employed in cooking each dish. The range contains four separate electric heaters of polished aluminium, which can be operated singly or simultaneously. By means of the electric clock, every dish can be cooked to precisely the proper degree. If, for example, a fowl is placed in the electric oven, it is known from M. Knap's experiments that it will require 30 minutes to roast it by radiation. The electric contact of the clock is, therefore, set at the figure 30, and at the moment when the desired number of minutes have elapsed, the current is automatically cut off, and an electric bell advises the twentieth century chef that his fowl is cooked to a turn.

Milk is automatically drawn into the stew pan, sauces and cakes need merely to be placed on or in the range, and the current does the rest. The cook can go off and smoke a cigarette without risk of burning his sauces or pastry. This method of electric cooking would not be very expensive when the current can be obtained from water power or from the waste power from a large motor.

The electric kitchen contains a rotating table, on which are placed machines for chopping meat, churning cream, washing dishes, and other apparatus, driven by a small dynamo. Some curious phenomena may be observed in this electric kitchen. For example, eggs are "boiled" without the use of water, and, in contrast to what occurs in cooking with wood, coal, or gas, a fowl begins to cook at the center, and the skin is not browned until the cooking is finished. M. Knap asserts that this method of cooking does not dry out the meat, and gives it a particularly agreeable flavor.

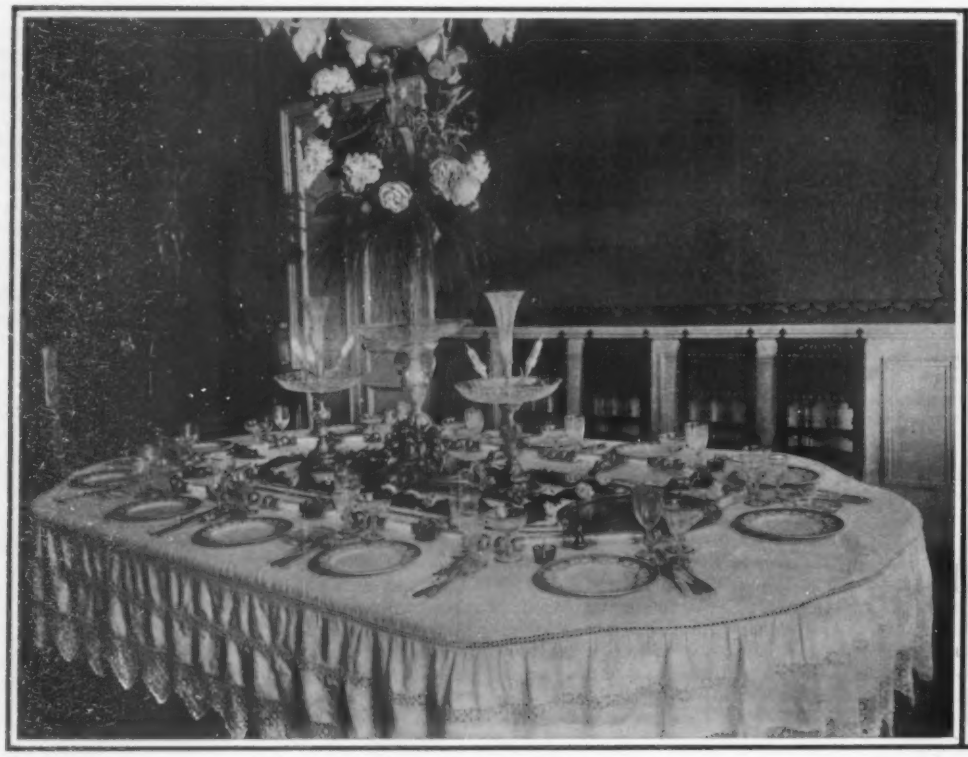
Near the kitchen is a laundry with electric washing machines, electric drying stoves, electric irons and ironing machines, etc.

In the bedroom we find other novelties. The hot-



Arrival of the dish on the table.

The electric kitchen.



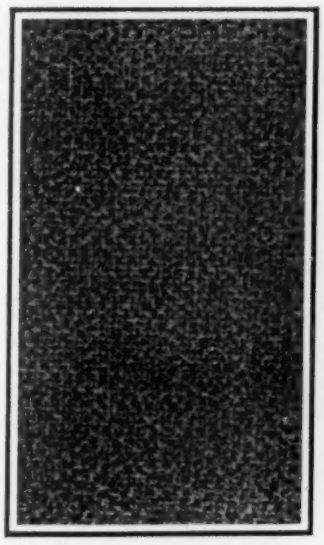
The electric dining table.

A bedroom in which breakfast is served by electricity.

AN ELECTRICAL HOUSEHOLD.

water bag or bottle is replaced by an electric bed warmer containing a small lamp, which is operated by compressing a bulb which hangs above the sleeper's head. In the morning the occupant of the room has only to press a button, and an elevator concealed in a small table will bring him his breakfast and his morning newspaper.

Finally, "electric spies," distributed in all the rooms behind the wall paper and the hangings and connected with sensitive microphones, make it possible for the master of the house, by pressing a button without leaving his bed, to know everything that is being done and said in the house.



Fabric for the crayon effect.

A landscape printed in the ordinary way.

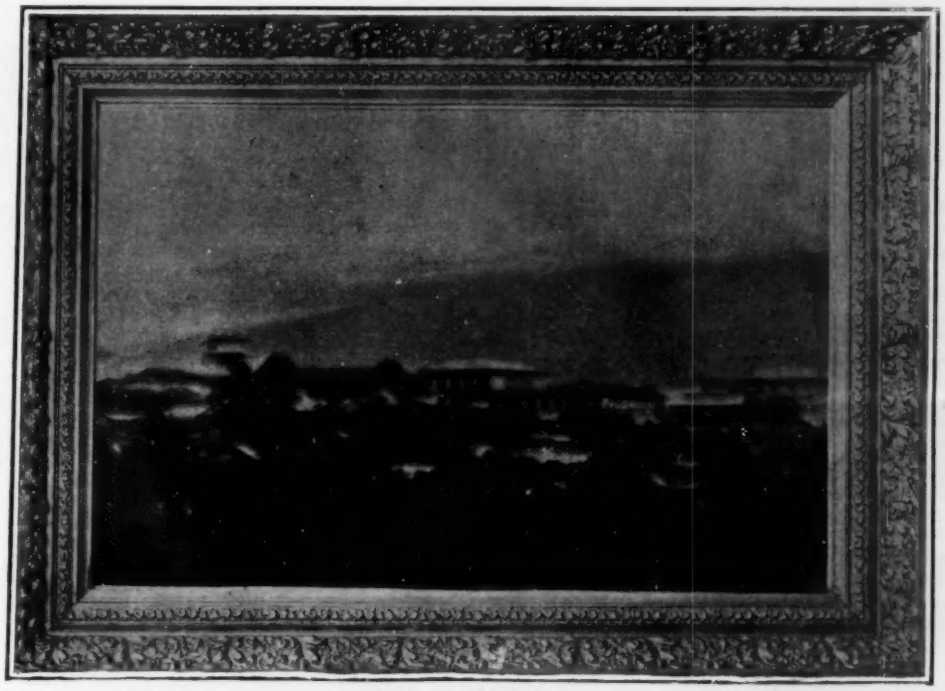
SOME PHOTOGRAPHIC DIVERSIONS.

BY GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

Anachromatic lenses, such as the common spectacle lens, are sometimes used by photographers who aim at the production of artistic effects. The breadth of interpretation observed in pictures made with those defective lenses is a result of the suppression of small details. The impression left by the masses of light and shade is that which is felt before crayon work or oil painting, or before the landscape itself when we enjoy it; that is, when we are not paying particular attention to some minute part of it.

Such artistic effects may be easily obtained with any objective, through the use of two implements, made once for all by the photographer himself, implements for which the names of "crayon screen" and "oil painting screen" would be appropriate.

The crayon screen breaks the uniform photographic shades into numberless and irregular dots, lines, or spots, so that viewed through a magnifying glass, they look very much like those produced by crayon drawn over rough paper. The screen may be made by copying with the camera and without reduction, a layer of crayon uniformly laid over coarse drawing paper. Better results are obtained by copying, with considerable reduction, some irregular design, made of spots, lines, and dots, on a printed fabric such as is found in every dry goods store. Herewith is the reproduction, in natural size, of the fabric used for the making of the screen with which the crayon effect in the accompanying engraving was obtained. If the screen is a film, it should be placed in the printing frame, between negative and paper. If it is a plate, it is most conveniently used in the negative holder, over the plate, and will then give, after a rather long exposure, a crayon effect negative. Most holders will take and keep in place two plates of ordinary thickness.



Same landscape as above made to represent the copy of an oil painting.

Photographs which look as if they were copies of artistic oil paintings may be made with any good negative and the help of the oil painting screen. This is merely a negative made from any framed oil painting, in which a piece of coarse cloth is substituted for the painting. A print is made with this negative. It is not toned or fixed and, with penknife and rule, the cloth central part is cut out from the print. This operation gives two paper masks, one of the cloth and one of the frame. Printing is made first with the negative of the landscape or portrait with the peripheral frame mask laid on the sensitized paper, the holder being placed about normally to the rays of the full sunlight, without ground glass but with a glass plate interposed between negative and paper. The distance thus introduced destroys the small details, leaving only masses of light and shade. The oil painting screen is then used in lieu of the negative. It is placed in direct contact with

Two photographs of similar subjects, one taken in the ordinary way, the other through a "crayon screen."

SOME PHOTOGRAPHIC DIVERSIONS.

the paper and frame mask until the canvas effect is clearly seen on the print. Last, the central mask is substituted for the frame mask, and a third printing gives the frame. The oil painting effect is the result of the contrast between the small details of the canvas and the seemingly broad technique of the picture over it.

How Hydraulic Power is Exported.

The government of Denmark proposes to carry out with the aid of its engineers the following plan: Upon the southern shore of the Sund is found the old city of Helsingborg, not far from which the Lagu rushes down from an elevated plateau over a stretch of about 30 kilometers. A fall of 100 meters is situated not more than 2 kilometers from the mouth of the Lagu. It is at this point and for the purpose of using this important natural motive force, that it has been decided to establish a hydro-electric plant, transmitting its current to Helsingborg (first relay). The submarine cables traversing the Sund permit the distribution of the electric energy produced in Sweden over the territory of Denmark. The Island of Seland, in which is found the Danish capital, will be the first to benefit by this installation, which will be very easily carried out; for between Helsingborg (Sweden) and Helsingör (Denmark) the arm of the sea is very narrow, not more than 5 kilometers wide; due to this circumstance the work necessary for the establishment of the submarine cables does not present any insurmountable difficulties.—La Nature.

Chinese Wild Silk.

M. Francis Marre, writing in Cosmos, gives some interesting particulars concerning the wild silk industry of China. A certain quantity of this silk, known under the name "water eel," is annually imported into France to be worked up in the factories of Lyons and Avignon, but the greater part of it finds its way to America, where it is made into a stuff called "radjah." Of late years, however, a considerable amount has been employed in the manufacture of balloons, a purpose for which it is peculiarly fitted by its strength and toughness.

The silk is obtained from a very common Chinese variety of the oak silkworm (*Antherea pernyi*). The larva feeds on the leaves of the *Cudrania triloba*, a dwarf oak which grows plentifully on the hills of Ho-Nan, Süchwan, and Kweichou. A warm, moist climate prevails almost all the year round in this mountainous district.

The cocoons of the oak silkworm are treated quite differently from those of the domestic silkworm which is fed on mulberry leaves. They are hung in long festoons sheltered from the sun, generally in buffalo sheds, in order that they may be kept at a constant warm temperature. They remain thus until the Feast of Spring (at the end of January or the beginning of February), when they are removed and hung up in a large room, of which all the doors and windows are carefully stopped. A hole is made in the middle of the roof to allow the escape of the smoke from a stove which is placed in the middle of the room. The stove is kept steadily burning for twenty days; at the end of this period the moths emerge from the cocoons and pairing immediately begins; the males and females are then separated, the latter being placed in palm-leaf baskets, where they lay their eggs. This operation takes about five days. Each female lays on an average some sixty eggs, which are about ten times the size of a mulberry silkworm's egg. After another interval of from fifteen to twenty days, spent in the room which has been closed and heated as before, the worms are hatched and are then taken in the baskets to the places where their food grows. The baskets are set down under the dwarf oaks, the flexible young twigs of which are arranged by the natives so as to make it easy for the worms to climb up to the leaves.

The worm feeds for two months, and then begins to make its cocoon, an operation which takes a week. The cocoons are collected toward the close of May, i. e., from three and a half to four months after the removal from the warm chamber.

The silk is wound and spun in two ways. In the first, which is used to produce a coarse material, the thread is spun from twenty cocoons. Silk of this kind is manufactured almost entirely at Süchwan. In the second the thread is spun from eight cocoons, and silk of this kind, which is made for the most part at Kweichou, is in greater demand for export purposes.

A pound of cocoons produces, as a rule, 240 grammes of fine silk. The average price varies from year to year. In 1907 it was 15 francs the kilogramme; in 1908, 22.6 francs.

Denatured alcohol costs more than gasoline and the quantity of denatured alcohol consumed by an alcohol engine as ordinarily constructed and operated is in general relatively greater than the quantity of gasoline consumed by a gasoline engine of the same type. It seems reasonable to expect a greater general improvement in alcohol engines than in gasoline engines.

Correspondence.

WHY WATCH SPRINGS BREAK.

To the Editor of the Scientific American:

I have read with considerable interest the discussion in the columns of the Scientific American relating to the breaking of main springs in watches. While the writer has had no direct experience along this line, the opinions given, while varying in detail and embodying many outside influences, seem to me to point to a common source, viz., the quality of material used in making the springs.

The opinion is constantly gaining ground among steel makers and steel users that the alloys and metallic compounds of iron are vastly more sensitive than those of any other metal, and that the composition and treatment of these substances constitute the foundation for their subsequent success or failure. The use to which the steel is to be applied should be known before the steel is made, and its composition as well as the process of its manufacture should be such as to produce the desired results. From practical results already attained, the writer is of the opinion that if these springs were made of a high-class crucible vanadium steel, and then subjected to a proper treatment, the trouble from breakage would be reduced to a minimum.

It would require too much of your valuable space to give reasons for this opinion, but I believe that a practical test of the material would lead to valuable results. Elwood Haynes.

Kokomo, Ind.

HOW DOES SAP RUN IN PINE TREES?

To the Editor of the Scientific American:

In about ninety per cent of all pine trees in this section, the fiber of the sap wood runs in a spiral around the tree contrary to the motion of the hands of a clock, i. e., from left to right in ascending the tree. This fact is easily observable in trees that have died, and from which the bark has fallen. Cyclones in the northern hemisphere revolve contrary to clock-hand motion. Probably the cause is the same in both cases; liquid sap moving like cyclones. It would therefore be interesting to learn whether this fact in regard to pines is universal throughout the northern hemisphere; and in order to determine the fact of identity of cause with the cause of similar direction of revolution of cyclones, it would merely be necessary to establish the fact that the fiber of pines in the southern hemisphere ascends in spirals that accord in direction with the motions of clock hands. Cyclones in the southern hemisphere, as is well known, revolve in the opposite direction from that of cyclones in the northern hemisphere.

Can some of your readers investigate along these lines, and report results? Does a top spinning in a vacuum weigh less than when it is not spinning? In other words, does the rotation of an object lessen its weight? T. C.

Sumter, S. C.

SAFEGUARDING MINES.

To the Editor of the Scientific American:

The recent mine horror in Cherry, Ill., being a sickening repetition of this sample of man's cruel neglect or indifference, emboldens the writer to trouble you with an indication, perhaps, of his ignorance merely, but which seems to him an idea that must have some value. He is not a trained mechanic, but living in a mining district and reading of the many coal mine accidents, he has not been able to forego all speculation on the subject.

It would seem that the energy of the entire body of mining engineers has been given to the problems of preventing mine explosions and other accidents which damage mines and incidentally cost miners their lives. I do not recall any efforts of theirs to devise means to safeguard the lives of the miners who are entrapped every time an accident happens. A year or two ago some miners were imprisoned in a mine, and were saved by accidentally finding an old gas or water pipe, through which they communicated with their friends and through which their friends lowered food and drink to them. This fortunate rescue has suggested that for a comparatively small cost a mine room here and there (so situated with respect to size and number and location of them as would ordinarily give refuge to all workers who were not killed outright by the accident) could be so equipped as to give refuge to as many as might be necessary, and harbor them until the mine passages could be opened. Why could not such rooms be provided with two-inch pipes, such as the ordinary bored well has, or the smaller hole of the diamond drill if the depth or quality of the rock made it necessary? Through these tubes air could be forced down and the foul air forced out, and food and drink passed down to the prisoners. Such rooms could be supplied with fire-proof and air-tight doors, and each door could have a wicket through which a belated and choking straggler could be quickly admitted. If such a plan would work, surely the cost would be nothing comparatively; even to having a pair of two-inch pipes going down to each room, equipped above with a strong pumping engine, by means of which large volumes of air could be constantly forced down. It will be objected that an explosion would destroy such rooms; to which the answer should be, it seems to the writer, "Leave the walls thick enough to withstand the worst of the ordinary explosions."

Surely, if such an idea or device would work, as it seems to the writer it must, the two or three hundred dollars that the equipment of each room might cost would seem a small expense to the mine owner if he had imagination enough to place himself in the place of the owner of the mine at Cherry. What would the owner of the Cherry mine give, if it were in his power, to instantly create enough such rooms as would give refuge to the three hundred men below, and be able to tell that frantic rabble of wives and mothers that owing to his foresight, humanity, and money, their men were safely cared for below, and would be fed, and they could communicate with them until the rescuers could release them? Under such conditions there would be no need to sacrifice the lives of those brave fellows who deliberately gave their lives by reason of their very eagerness to help their fellows.

Birmingham, Ala. George L. Brown.

AN EARLY MARINE ENGINE.

To the Editor of the Scientific American:

The following from an old New York American may be of interest, especially at this time of looking up ancient types of steamships:

"In the year 1819, while experimenting for the improvement of the steam engine, my attention was arrested by the great loss of heat under the circumstances in which steam is generally produced, and the idea of my present generator suggested itself to my mind at that time; . . . and in March, 1825, made the first experiment in R. L. Cawdrey's carriage shop, Ithaca, N. Y. . . .

"I used a blacksmith's bellows to supply the fire with air, . . . and concluded that about eight times as much steam was generated as air forced into the fire. . . .

"The engine (which was installed in a Liverpool packet) is called a 'double steam engine,' having two steam cylinders of thirty-five inches diameter, six feet stroke; two blowing cylinders of just half the capacity; which are worked by the engine, and the air is conducted into a boiler whose outer cylindrical case is four feet in diameter and twelve feet high; the furnace, or inner case, is three and a half feet in diameter and nine feet high. The fuel is introduced into it down the chimney, and it is so constructed that not one particle of heat can escape, but must absolutely pass into the water, together with all the gases generated by combustion, and become as strong an agent as the steam itself, passing through the steam cylinders with it."

The inventor, P. Bennet, of Ithaca, seems to have had a great deal of trouble with tar in his cylinder, as we would expect, but claimed to have overcome this difficulty. Walter C. Bilelur.

Holbrook, Mass.

The Current Supplement.

The current Supplement, No. 1770, may be regarded as a North Pole number, for it contains two articles on the Pole. One of them, by Washington Platt, gives a very complete history of Polar exploration, and shows what terrible hardships have been endured in the past in a quest which has no other reward than that of glory. Prof. Messerschmitt, on the other hand, contributes a strictly scientific article on astronomical and geophysical conditions at the North Pole. Although scarcely ten years have elapsed since Marconi made his first really conclusive experiment, wireless telegraphy has already become an art. Some recent developments in this art are reviewed by H. Marchand. W. B. Huff contributes an excellent article on demonstrations with the musical arc. "On Board the 'Parseval'" is the title of an article by Robert Saudek, in which he describes interestingly a trip in the famous German military dirigible. "Engine Power from Solar Heat" is the suggestive title of an article which will be read with much interest. A hop-picking machine which will have a marked effect on the hop industry is described and illustrated. In view of the return of Halley's comet, which has now been found by the telescope, some account of the great astronomer with whose name the comet is associated may prove of interest to the general reader. J. E. Gore contributes such an article. The conclusion of the article on machines that make cordage, begun in the last Supplement, is published. A. E. Shipley tells how zoology is being organized.

Dr. Torp, rector of the University of Copenhagen, has selected Prof. Elis Stromgren, Director of the Astronomical Observatory, as head of the committee to examine Dr. Frederick A. Cook's records. These are expected at Copenhagen about December 7th.

A NOVEL AERIAL RAILWAY.

A German engineer named Leps has conceived a novel and marvelously impracticable mode of transit, a sort of cross between the airship and the electric railway, in which a balloon supports the weight of passenger cars, which run on aerial cables and are propelled by electricity. According to Umschau, whence we derive our information, the balloon is a horizontal cylinder with conical ends of the rigid Zeppelin type of construction. It is about 200 feet long and 33 feet in diameter. On each side, at the level of the axis, are pairs of small horizontal wheels which move between guiding cables supported by tall latticed steel towers. The function of these wheels and cables is to counteract the force of the wind. A wheel on the windward side is pressed against the inner cable, and a wheel or roller on the leeward side is pressed against the outer cable, and thus the stress is equally divided between the windward and leeward towers, and also between the two sides of the balloon.

Beneath the balloon, and attached to it, are the cars, each of which accommodates 60 persons. The cars and connecting passages are made of steel, wood, and canvas, and provided with windows. There is a small forward compartment for the motor and the motorman. The larger compartment is furnished with revolving chairs and folding tables, for the use of passengers. Even toilet rooms are provided. The cars are heated and lighted by electricity, and are propelled by electric motors capable of developing a speed of about 125 miles per hour. The motor shaft is extended outward, and each end carries a driving wheel which runs on a propulsion cable. Below this directly-connected wheel and the cable is another driving wheel mounted on a movable axis, so that it can be brought to bear on the cable from beneath. Thus the cable is pressed tightly between the concave rims of the two wheels, producing ample friction for traction, and the car is propelled as on an ordinary electric railway. The propulsion cables, which are guide cables as well, are supported by latticed towers, which are shorter and lighter than the main towers, with which they are connected by trusses. An electric cable, suspended between the propulsion cables but at a lower level, furnishes current to the motors by means of contact wheels beneath the cars. The brakes are applied, not to the wheels, but to the propulsion cables.

At present this novel railway exists only on paper. In order to test the practicability of the scheme it is proposed to construct a short experimental line from Marburg to the summit of a neighboring hill, the Frauenberg, 1,250 feet higher than the Marburg terminus. The promoters calculate that the operating expenses of a railway of this kind would be about one-fortieth those of an ordinary railway, and that the diminution in the cost of right-of-way would reduce the initial outlay to about $30,000 per mile. According to the estimates of the company, a line from Berlin to Hamburg could be constructed for less than $4,000,000, and the English Channel could be crossed at a cost of $5,000,000, while the 6,000-mile journey from Berlin to Vladivostock, which now occupies seventeen days, *via* the Siberian railway, could be accomplished in three days by the Leps aerial railway. We would venture to point out that the limited number of passengers which an airship car could carry would mean a prohibitive fare. Count von Zeppelin, we believe, intends to charge $125 for a trip from Switzerland to Hamburg on one of his aeronautic "Lusitanias." Although there may be curious applicants in plenty for airship reservations, it is not likely that railways will suffer from Count Zeppelin's competition. There are engineering as well as financial objections to Leps's scheme. Zeppelin has found it difficult to anchor his airships in high winds. It is probable that storms will play havoc with an enormous gas bag held in place merely by rollers. A railway or foot bridge must be provided with more or less wind bracing if it is of any length, and it would seem that similar provision ought to be made for an airship train. The problem is hardly likely to engage serious attention, for it is not likely that this fanciful road will ever be constructed.

In some metallurgical and chemical operations steam is admitted to large vats or tanks for the purpose of agitating, and, in some cases, heating their contents. In special cases, the consumption of steam for this purpose is enormous. It is often possible to obtain better results by mixing air with the steam. This may be accomplished by using an ordinary injector. To insure the proper working of the device, the steam is first turned on, then the valve of the injector gradually opened until the desired amount of air is obtained. By the use of this device, better agitation is secured, the contents of the tank or vat suffer less dilution, and there is a large saving in the amount of steam used.

Destruction of Wood Borers.

BY R. B. HOOPER.

In our waters there are two genera of mollusks, viz., Xylotrya and Teredo, and three of crustaceans, viz., Limnoria, Chelura, and Sphæroma, that attack and seriously damage structures of wood in salt water. The Xylotrya and Teredo are very similar in structure and action. The former are by far the more numerous, and what are commonly called Teredo are, in the large majority of cases, Xylotrya, and all references to the Xylotrya will be understood to refer to both genera.

When first coming to life the Xylotrya is very minute, being the thickness of a hair and about one-twentieth of an inch long. When very young it attacks the wood in countless thousands, and immediately begins to bore.

In structure it is comparatively simple. Its body consists mainly of a tube beginning at the posterior end of the body, running to the head, and then returning to the posterior end. At the head end is a sucker-like foot or tongue inclosed in two shell valves which are provided with fine, hard, tooth-like protuberances. It is with these valves that the boring is made. Through the longer end of the tube water is taken in, passed through the body, through the return tube, and is ejected through the shorter end with the wood borings and the excreta. It does not appear that the Xylotrya gathers any sustenance from the wood, its food consisting only of the infusoria in the water.

Of the crustacean borers the Limnoria, or "wood louse," is the only one of great importance. It is about the size of a grain of rice, and tunnels into the wood for both food and shelter. The little galleries excavated are about one-half inch long and extend inward radially, side by side, in countless numbers, so that the wood partitions between them, which are very thin, are soon destroyed by wave action, thus exposing a fresh wood surface to attack.

A new method of destroying these borers has been found. The piles to be treated are inclosed by a canvas apron supported by floats, and kept in an upright position in the water by weights at the lower end. The inclosed space is ordinarily not more than 40 x 80 feet square. The water in the inclosure underneath is decomposed by means of an electric current, and chlorine, with small quantities of bromine and iodine, are formed, rising through the water around the piles. By a mechanical contrivance the apron and electrical terminals can be lowered to the mud level and gradually raised, the gases being constantly generated in the inclosure. As previously seen, the Xylotrya draws in water through one end of the tube, always exposed, which passes through the entire body. It has been proven that a mixture of one part of chlorine to one-half million parts of water is sufficient to destroy life in marine animals, so a very small quantity passing through this breathing tube causes death. As the Limnoria obtains a part of its food from the water, the same result is obtained with this type of borer. It is true that one application of this method simply kills the borers existing in the pile and surrounding waters, and does not prevent further ravages from others, but the process is so cheap that it can be applied as often as necessary, say every two or three months, thus insuring long life to an unprotected pile.

A public demonstration of this method of destroying wood borers was recently made in the waters of Elliott Bay, the inventors using for the purpose of generating the chlorine gas a current of 100 amperes at about 12 volts.

After the treatment the pile was left in the bay for twenty-four hours, in order that should there be any power of revival it might manifest itself; then it was cut open, and all Xylotrya were found to be dead. The result was accomplished principally by the corrosive action of the chlorine upon the exposed parts of the Xylotrya, that is, the so-called "tail," which in reality constitutes both their feeding and breathing organs. It appeared that all exposed tails in the pile thus treated turned white, while when the animal is alive, they are a dark gray. As the chlorine penetrated the borer it coagulated the albumen which constitutes part of the body and which shows itself in white spots. The original appearance of the Xylotrya when alive is almost transparent and glassy.

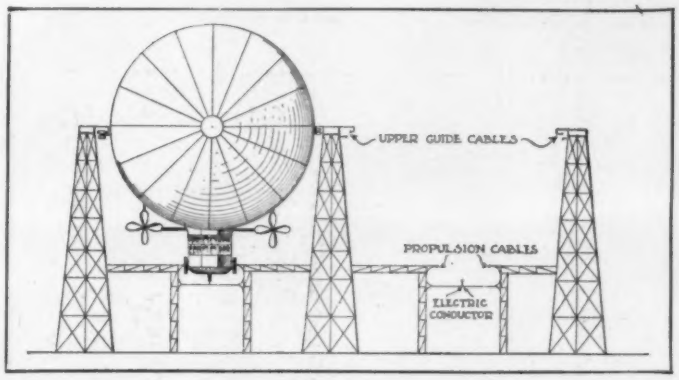


DIAGRAM OF LEPS AIRSHIP RAILWAY.

The Quebracho Tree of South America.

The quebracho is a tree of South America (Argentine Republic), where it forms entire forests, but nevertheless has been, until now, almost completely unknown. Its use is now beginning to spread among tanneries, and for two reasons: First, its high content of tannin, which amounts to 18 to 20 per 100 pounds weight of wood and bark; second, the discovery of chemical methods of treating the extracts, which facilitate the employment thereof. It was a German tanner of Buenos Ayres who was the first to find that extracts of quebracho wood were able to tan hides; but the first sample of the wood was carried into Europe by way of Havre in April, 1875, by Dubosc, who undertook the industrial manufacture of the extract. The employment of the extract developed difficulties consequent upon the peculiar property of the tannin. When one extracts the tannin from the bark by boiling water, the solution deposits on cooling the insoluble tannin, while there remain in solution soluble tannins and the glucosides, or non-tannins. These three components operate during the tanning, the soluble tannins combining with the fundamental substance of the skin, the non-tannin fermenting and giving the acids, which are necessary for "plumping" the hides, and which facilitate the absorption of the tannin; the insoluble tannins finally penetrate uniformly into the pores and render the hide impermeable. The quebracho is composed of 20 parts of soluble tannins in 100 parts, and only 2.5 of non-tannins per 100, while it does not contain any glucosides; it is therefore not able to furnish enough acid by fermentation. But if one adds thereto acid liquors resulting from other extracts, there is produced a precipitation of soluble tannin, which renders the tanning process very difficult.

Attempts have been made from the first to eliminate the insoluble tannins by addition of lead acetate, alum, albumen, etc., and to thus obtain a clarified and decolorized extract, but these attempts have not solved the problem. After that endeavors were made to render the insoluble tannins soluble; two Italian chemists, Leptit and Tagliani, found that by a treatment with alkaline bisulphites, the non-soluble compounds were able to remain in solution and also in the acid liquors. This process, patented in all countries, has made feasible the universal employment of quebracho. In the United States there was employed in 1901 not more than 5,000 tons of extracts; in 1907, six years after the discovery of the bisulphite process, 50,000 tons were consumed; in 1909, 70,000 tons. The extraction is effected *in situ;* on the Parana River is found a plant producing 50,000 tons per year.—La Nature.

Wireless Telegraphy Between London and South Africa.

There are being carried out at this time trials looking toward the establishment of direct telegraphic communication by wireless between South Africa and England; this is being done at Durban in Natal. In spite of the immense distance, it is hoped that a satisfactory result will be obtained, particularly since it is known that the propagation of Hertzian waves occurs with much greater facility along the meridians of longitude than it does over the parallels of latitude. In undertaking the operation of wireless telegraphy between America and Europe, a task was assailed which was really more difficult. Fortunately, in this latter case, the fogs of high latitudes furnished facilities which may perhaps not be found in the South African line.

Since high towers are very expensive to erect, it is proposed to supplant them at Durban by kites, which will carry to a height of 300 meters the extremities of the antennæ, and it has already been estimated that the cost for transmitting messages may be successfully placed at 1.25 francs per word.—Cosmos.

Water Varnishes.—Solutions of resin in alkalies and water have been suggested as cheap varnishes, but owing to their lack of durability they are used only for common painting. Their preparation is very simple: dissolve the alkali (soda or potash) in the quantity of water decided on, heat it to boiling, add the resin gradually, in small quantities, stirring contantly, and clear by standing. Floor varnish, with shellac, 30 parts water, 3 parts crystallized soda, 5 parts shellac. Floor varnish with shellac and color, 20 parts water, 2 parts crystallized soda, 4 parts shellac, 4 parts washed ocher. The varnish is prepared as at first described, the ocher is added after cooling and thoroughly shaken up, and the whole ground in a paint-grinding machine.

HOW TO OBSERVE AND RECORD THE WEATHER.

BY THALEON BLAKE, C.E.

The weather is always with us. Upon its condition depends our physical comfort, our material welfare, our food supply, our outdoor amusements, our sports, and to a certain extent the prosecution of our business enterprises. Because men are so intimately, so profoundly affected by environment, the study of climate is receiving more and more attention from progressive governments.

Each day wears its appropriate dress, summer or winter; and the observation of this daily individuality of the weather constitutes a major part of the duties of weather observers. The United States Weather Bureau forecasts the weather, issues storm warnings, displays frost, cold wave, and flood signals; receives, tabulates, and distributes meteorological information for the benefit and safeguarding of agriculture, commerce, and navigation. About two hundred regular observing stations are maintained in the United States and the West Indies, each in charge of a trained observer, who telegraphs to Washington the weather conditions from his local office twice a day—8 A. M. and 8 P. M., seventy-fifth meridian time.

On these observations are forecast the weather conditions for the ensuing thirty-six to forty-eight hours. All of these stations have mercurial barometers, thermometers, wind vanes, rain and snow gages, and anemometers. Many of them have in addition, sunshine recorders, barographs, thermographs, that register, automatically and continuously, the changes of the weather. The governments of Mexico, Canada, England, Germany, France, Portugal, and some others, more or less effectively, maintain similar services, so that, by exchange of information, the weather conditions that obtain over North America, North Atlantic Ocean, and West Europe are very thoroughly observed, and forecasts made with dispatch and accuracy.

The art of predicting the most probable condition of the weather for the ensuing twenty-four to forty-eight hours depends on the observations over a considerable area, and on the experienced judgment of the forecasters in predicting conditions likely to follow those at the time of taking the observations.

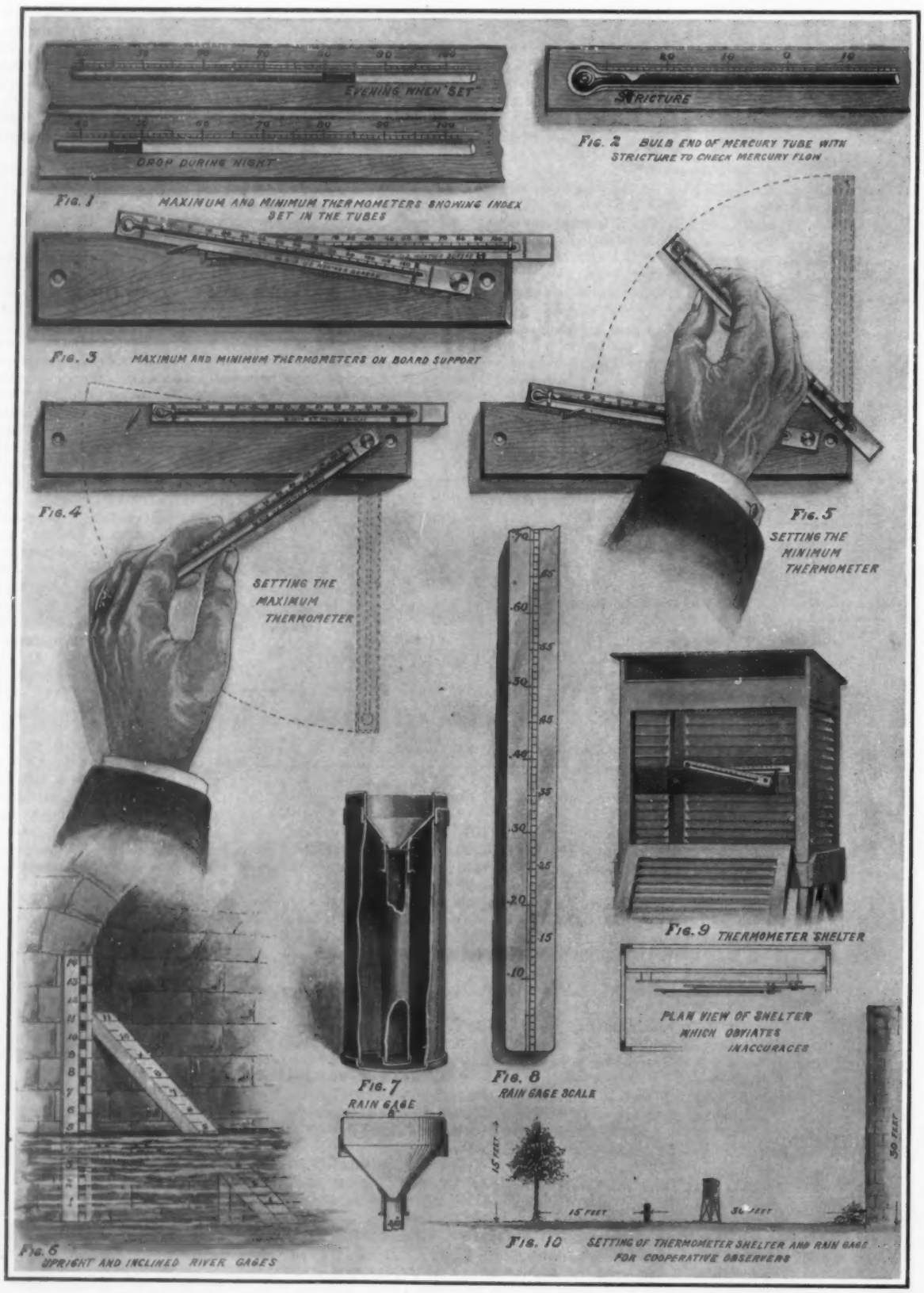
There seems to be much mystery attached by the general public to the observation and recording of the weather. This supposition is erroneous. The weather itself is seldom complex. At a given hour on any day, it is hot or cold; the sun shines or the sky is overcast; it rains or snows, or there is no precipitation; the air is calm or breezes blow, or there is a hurricane. The weather being reducible to such simple terms, it follows that a comprehensive record of observations need not be abstruse to be valuable. Nor is the observation of the weather by co-operative observers of the Weather Bureau difficult to learn or to take. The great extent of the territory of which it is necessary to have reports, would render impossible any large corps of observers if they all had to be paid. Fortunately, hundreds of people are interested enough to volunteer their services to the government. This enables the Weather Bureau to multiply its observers at little more cost than that of supplying the instruments and the stationery, all of which are lent to responsible and experienced volunteers. The co-operative observers, as a whole, although serving without pecuniary compensation, display much interest and care in their work. Through its principal stations, the Federal government supplies the co-operative observers with thermometers, a shelter in which to house them, and a rain gage. Some may have a larger equipment; but these comprise the customary number.

It is required of co-operative observers that they read the thermometers once a day, at 7 P. M. The temperature is read on thermometers exposed to free air. Two thermometers are necessary to obtain the highest and lowest temperature, named, respectively, the maximum and the minimum thermometers. The minimum thermometer registers the lowest temperature for the past twenty-four hours. It is filled with alcohol, and its registering of the lowest temperature is accomplished by means of a double-headed, pin-like object, called an index, that slides freely in the alcohol within the glass tube. Solely because the index remains in the alcohol, it is enabled to go down and register the lowest temperature of the period since it was last "set." (Fig. 1.)

For instance, if, during the night, the temperature falls from 85 to 50 degrees, the alcohol column descends, of course, toward the bulb. Then the end, or top surface, meets the head of the index, and takes the index down with it. While the index will not suffer the alcohol to pass on down, and leave it in the vacuum above, it will allow the alcohol to flow above it, meanwhile remaining at rest at the lowest point reached by the top of the column of alcohol. It is obvious that because the index will not permit the surface of the alcohol column to flow past it on the way to the bulb, but will lie still when the column of alcohol flows upward with the increase of warmth, the lowest temperature is registered. The maximum thermometer is designed to register the highest temperature of the preceding twenty-four hours. It is filled with mercury, which, owing to a stricture in the tube near the bulb (Fig. 2), can flow freely from the bulb as the temperature rises, but when the temperature falls, it cannot easily flow back. Thus imprisoned above the stricture, it registers whatever degree was the highest attained by the temperature for twenty-four hours.

The words "top" and "bottom" are used advisedly, as the minimum and maximum thermometers are

(*Continued on page 418.*)



HOW WEATHER DATA ARE COLLECTED FOR THE WEATHER BUREAU BY AMATEUR OBSERVERS.

TESTING THE MAN-ENGINE.

BY JOHN ELFRETH WATKINS.

Of the many man-engine testing plants which have been instituted within recent years, the most interesting are those which are now studying the self-directing function of the human machine. In these workshops man is continually making surprising discoveries about himself.

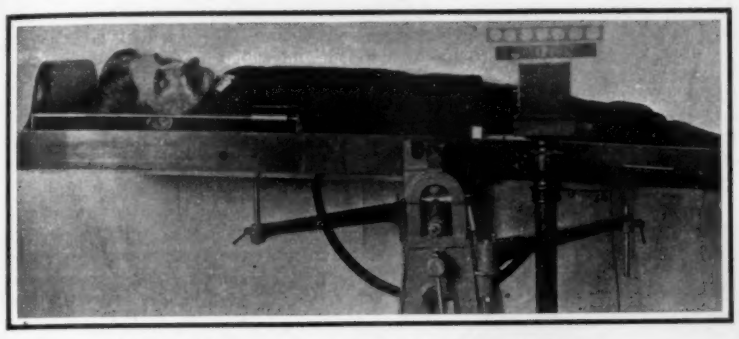
Perhaps the most engrossing item in their equipment is a gage for use in determining the man-engine's speed in starting, stopping, or directing its course after receiving a signal. It is a clock which records thousandths of a second, and an electric current can start and stop it within an imperceptible interval. Several complicated instruments can be connected with it in such a manner that upon the instant a sound is made, a light is flashed, or a color, a letter, or a word is exposed, the electrical impulse giving such a signal will start the recording hand.

The subject, with a finger pressing a telegraph key, is told that as soon as he hears, sees, or feels the signal he must release his finger from the key. The signal itself automatically closes the current and starts the clock, while the lifting of the finger from the key breaks the current and stops the clock. The number of thousandths of a second scored by the clock meanwhile measures the time required by the mind in perceiving, understanding, and obeying the signal.

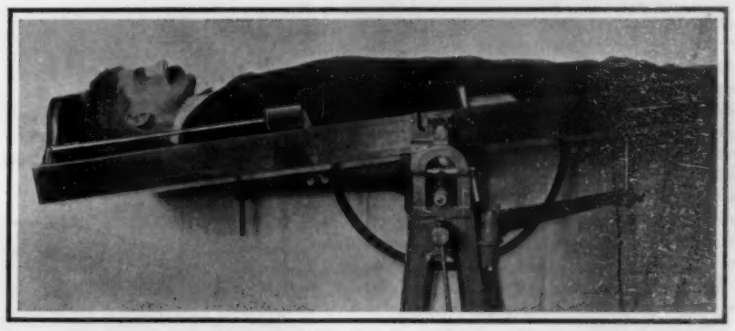
Thus, this man-engine gage will measure the time which you require to recognize or name a letter, color, or object; to read a word or sentence; to add, subtract, multiply, or divide; to remember your own name, your address, the meaning of any word in any language. Comparative tests thus far indicate that the average mind obeys a sound signal in 125 thousandths and a light signal in 160 thousandths of a second and that the ear therefore is quicker than the eye; also that the eye requires about the same time to read a word of five or six letters as to read a single letter; that a person remembers his own name more quickly than that of his best friend—even that of his wife; that he recollects the country in which his own city is located more promptly than that in which Paris is, for instance. According to Prof. Lightner Witmer, of the University of Pennsylvania, men hear, see, or feel signals more quickly than do women, and Indians appear to be quicker in this respect than are whites.

Of all the man-engine's working-levers the arm is the most industrious. The quickness of its movements

(*Continued on page 420.*)



Measuring circulation in brain. Asleep, head up.



Measuring circulation in brain. Solving a problem. Head down.

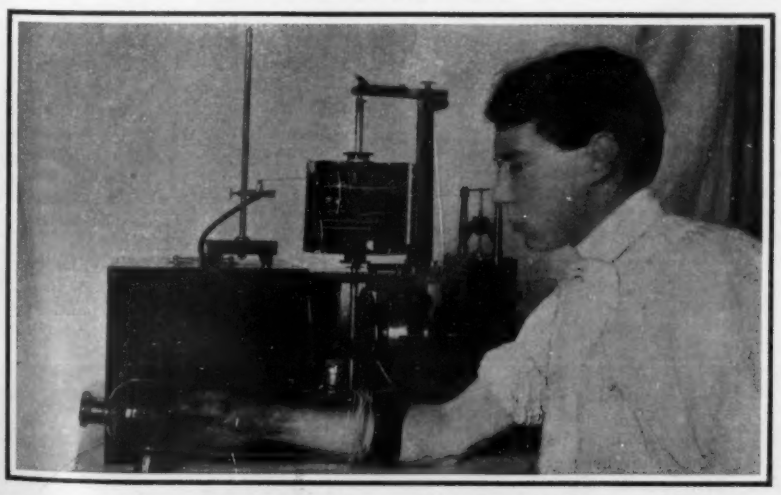
Effects of thought on muscular power.

Testing the acuteness of touch.

Testing the acuteness of smell.

Involuntary hand movements.

Measuring lip movements.



Effects of thought on circulation of blood.

Timing the arm's speed.

TESTING THE MAN-ENGINE.

THE HEAVENS IN DECEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

THE prediction of the return of a periodic comet involves a number of difficulties which are not met with in similar calculations concerning the planets. Comets, especially those of long period, move in very elongated ellipses, and can be observed only when relatively near the sun, since at great distances they are too faint to be detected. We have therefore to determine the form and dimensions of the orbit from an "observed arc" which may be only one-tenth or one-twentieth of the whole.

A very small error in the observed positions—which may easily occur, especially for a comet which has no sharply defined nucleus—may thus lead to a much greater uncertainty in the calculated dimensions of the orbit, and the resulting time of the next return.

In much the same way a small change in the direction or rate of the comet's motion, such as may be caused by the attraction of a planet near which it comes, may lead to considerable changes in its period, and in the other elements of its orbit. These changes, unlike the effect of observational error, may be accurately calculated, though only by very laborious processes.

When a comet has been observed at two or more returns the influence of observational errors is greatly diminished, and its future behavior, or its past history, can be determined with a high degree of accuracy.

It is thus possible to utilize the ancient chronicles of astronomical events, which have been preserved in various parts of Europe and also in China, and to see whether earlier relics of the body under investigation can be identified.

It is of course insufficient to find the mere statement that a comet was seen in a certain year, for there are many cases on record when two comets were visible within that interval. We need specific information from which the comet's apparent place in the heavens at a known date can be inferred. If this agrees with our calculations, or, at least, does not depart from them more than is reasonable to attribute to the errors of naked-eye observations and rough descriptions, the identity of the comet is assured.

This procedure has been adopted by Messrs. Cowell and Crommelin, of the Greenwich Observatory, whose work is noteworthy no less for its practical ingenuity, from the standpoint of the calculator, than for its signal success.

Working backward from the last return in 1835, they found returns in 1759, 1682, 1607, 1531, 1456, and 1378 already definitely established by the work of preceding astronomers. Those of the sixteenth and seventeenth centuries were the basis of Halley's notable discovery of the periodicity of the comet, which causes it to bear his name. The next previous return should have occurred on October 26th, A. D. 1301, only four days later than the date deduced by Hind from the Chinese observations of a comet in that year. The difference is quite within the errors of such rough estimates of position. It is noteworthy that the European observations (or at least the existing records) of the same comet are much less accurate than the Chinese—a curious reversal of the present state of things. Still working backward, the returns of the comet in the years 1222, 1145, 1066 (a famous comet which appeared just before the Norman Conquest of England) and 989 can be identified in the chronicles.

At the preceding perihelion passage in 912 there are vague references to a comet or comets, in addition to a bright one which appeared some four months earlier than Halley's could have done, but nothing sufficiently precise for identification. On the other hand, the return in 837 is well described, and that in 760 was recorded by the Chinese with sufficient detail to enable M. Laugier many years ago to show from the observations alone that the orbit of this comet, in its visible portion, was practically the same as that of Halley's comet.

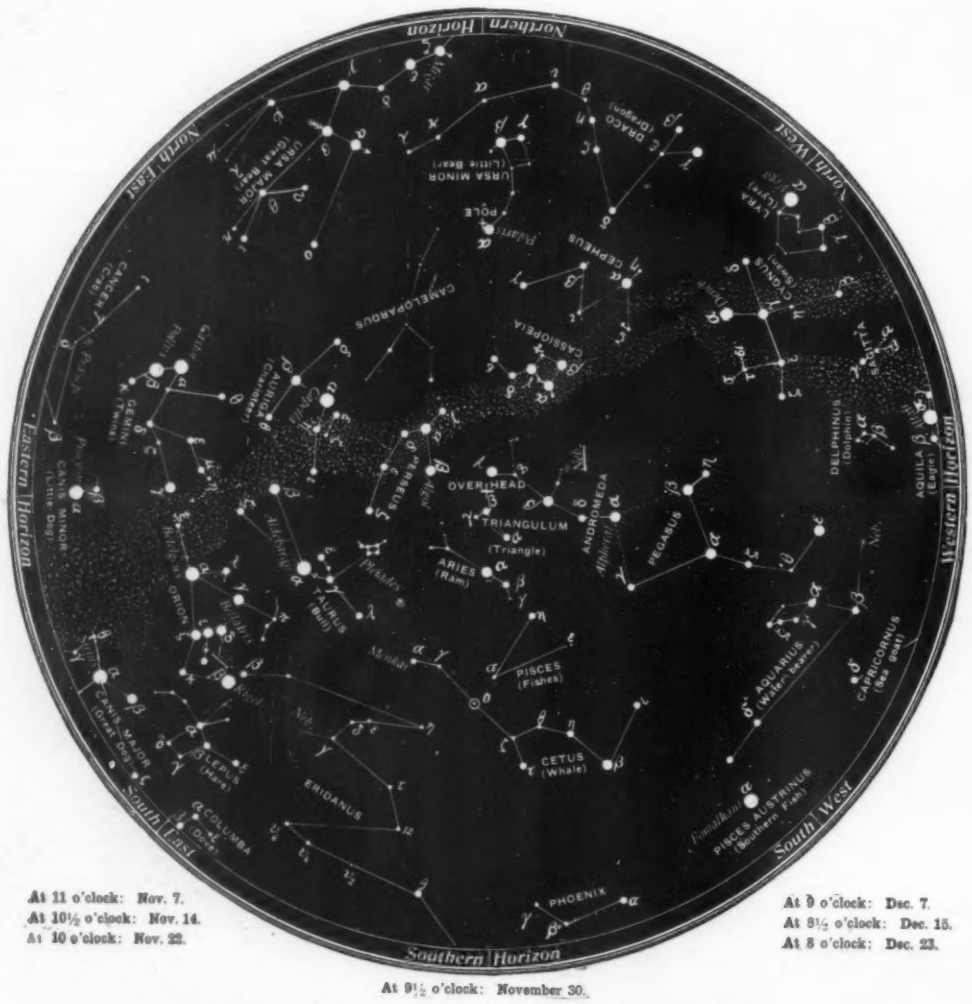
The return of A. D. 684 was observed in China and Japan. In 607 at least two comets appeared, one of which was doubtless the object of our study. The apparition in 530 is again definitely identified, and the Chinese observations of 451 are by themselves conclusive as to the comet's identity.

Even here the end is not reached. The returns of A. D. 373, 295, 218, 141, and 66, all appear to have been observed and also those in B. C. 12 and B. C. 87. A comet observed in China in 240 B. C. was probably a still earlier return. Beyond this there are no sufficiently definite observations, though a record of a comet seen in B. C. 467 may perhaps refer to a still earlier apparition.

This is an impressive record, which may well give rise to reflection—on the indefatigable energy of the computers, and not less on the remarkable care of the ancient star-gazers and of the scribes who preserved their records. But from the standpoint of general interest, it is most of all noteworthy that the comet has been a conspicuous naked-eye object at at least twenty-four out of its last twenty-six returns, and probably at the other two, where the records are incomplete. We have therefore very good reason to anticipate a fine sight next May, when the comet will be for a few days unusually near us.

At the present apparition, the twenty-fifth which has been certainly observed, the comet is still too faint to be seen without a large telescope, and will remain so until early in the new year. In spite of its faintness, its spectrum has been photographed at the Lick Observatory, showing no trace of bright lines or bands, but only a faint continuous spectrum, such as reflected sunlight would give with the instrument employed.

The awakening of the comet's activity as it approaches the sun had apparently not yet begun. Its progress will be of great interest.



At 11 o'clock: Nov. 7.
At 10½ o'clock: Nov. 14.
At 10 o'clock: Nov. 22.

At 9½ o'clock: November 30.

At 9 o'clock: Dec. 7.
At 8½ o'clock: Dec. 15.
At 8 o'clock: Dec. 23.

NIGHT SKY: NOVEMBER AND DECEMBER

THE HEAVENS.

There is no time in the year when so many of the brightest stars can be seen at once as at present. Looking first to the westward, we find Altair in the constellation of the Eagle, just setting at the hour assigned on our map, but clearly visible a little earlier. Almost due northwest, and a little higher, is Vega, above which is the less brilliant but equally white star Deneb, in Cygnus. The lonely star far down in the southwest is Fomalhaut.

Above this the southern and western sky boasts no very bright stars, but the planets Mars and Saturn are there, close together, in Pisces.

The finest group of all is in the southeast. Low down, and twinkling violently in the winter air, is the splendid Sirius. Above him is Orion which boasts two stars of the first magnitude—Rigel on the right and the ruddy Betelgeux on the left. Due east, and low down, is the lesser Dog-star Procyon. Above on the left are the twin stars Castor and Pollux, and higher still is the brilliant Capella. Across the Milky Way from the last is Aldebaran, the brightest of the stars of Taurus.

This fine constellation, which is shown in our initial, is, like Pegasus, supposed to represent only the head and fore-legs of the Bull. The stars β and ζ on the edge of the Milky Way, mark the tips of his horns. Aldebaran is one of his eyes, and the little V-shaped group of the Hyades, of which it forms a part, marks his face, while the Pleiades are in his neck. Like all the animal-figures in the zodiac, the constellation is of very great antiquity.

Of the constellations not already mentioned we may note the vast and faint areas of Eridanus and Cetus in the south, and the familiar forms of the two Bears and the Dragon beneath the Pole, of Perseus, Cassiopeia, and Andromeda high above us, and of Pegasus to the westward.

THE PLANETS.

Mercury is morning star until the 3rd, and later evening star, but is not favorably placed, and can be seen only at the end of the month, when he sets about 5:45 P. M. far to the south of west.

Venus is also evening star, and is very conspicuous. She is at the greatest elongation (apparent distance) from the sun on the 2nd but is then far south and becomes still more prominent as she comes northward. By the end of the month she remains in sight until after 8 P. M. and is very bright.

Mars is in Pisces, and comes to the meridian about 7 P. M. in the middle of the month. He is moving eastward among the stars, toward Saturn, whom he overtakes on the last day of the year, passing about three degrees north of him. By this time he is 90 million miles distant, and only one-eighth as bright as he was in September.

Jupiter is morning star in Virgo, rising about 1 A. M. in the middle of the month.

Saturn is in Pisces, near Mars, from whom he can be distinguished by the yellow color of his light. Uranus is in Sagittarius and unobservable. Neptune is in Gemini, approaching opposition, and is visible (with sufficient telescopic power) most of the night.

THE MOON.

The moon is in her last quarter at 11 A. M. on the 4th, new at 3 P. M. on the 12th, in her first quarter at 9 P. M. on the 19th, and full at 4 P. M. on the 26th. She is nearest us on the 23rd, and farthest away on the 7th. In her circuit of the sky she passes Jupiter on the 6th, Mercury on the 13th, Uranus on the 14th, Venus on the 16th, Mars on the 20th, Saturn on the 21st, and Neptune on the 27th.

At the present new moon there is a partial eclipse of the sun, which, since it is visible only in New Zealand and the Antarctic regions, is of little account.

Princeton University Observatory.

The Santa Fé Railway Company proposes to electrify the line over Raton Pass for a length of thirty-eight miles, between Trinidad, Colo., and Raton, N. M. For this purpose, says Power, 15,000 electric horse-power will be required for twenty-four hours' consumption in hauling goods and passenger trains through the Rocky Mountains. The change from steam to electricity will involve an expenditure of about $1,500,000.

CURIOSITIES IN SCIENCE AND INVENTION.

PEDALING ON WATER.

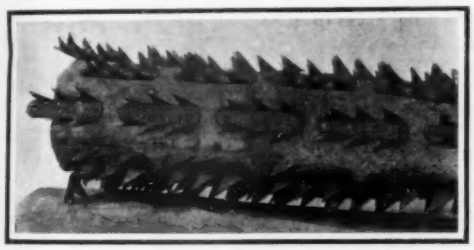
Every once in a while an inventor comes forth with some new contrivance for traveling over water, which though of no practical utility is interesting because of its novelty or oddity. Pictured herewith is a

A CURIOUS SAIL AND PEDAL PROPELLED CRAFT.

very queer craft comprised of three floats which support a bicycle frame. The navigator sits on the bicycle seat, operating the pedals in the usual way, and the latter are geared to a screw propeller, which drives the craft forward. The front float serves as a rudder. As progress is rather slow, a small sail is provided, which is attached to the forward float of the craft.

THE ICE DRAG OF THE WELLMAN EXPEDITION.

One of the curious contrivances gotten up for the Wellman airship expedition to the North Pole was a drag that would retard backward drift when the airship was encountering head winds too strong to permit of anchoring. It consisted of a long leather tube,

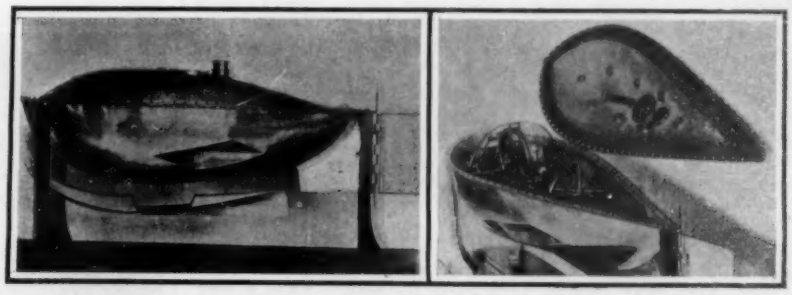


AN ICE DRAG FOR AIRSHIPS.

armed with steel spurs adapted to dig into the ice, as it trailed over the surface. The tube also served as a reservoir for food. It was ingeniously figured out that as the balloon gradually lost its lifting power because of the leakage of gas, the drag would also become lighter because of the consumption of food, and thus its dragging effect would always be proportional to the weight of the airship.

AN EARLY TYPE OF SUBMARINE BOAT.

Whenever a prominent invention is reduced to practice, the inventor finds his claim to originality called in question by the work of some obscure inventor living generations before. It does really seem as if there were nothing new under the sun. In the early part of the last century a friend of Herr Leeghwater, the celebrated Dutch engineer, spent all his fortune and ran deeply into debt by constructing a model of a submarine boat. Illustrations of this remarkable submarine are shown herewith. The boat was of porpoise shape, and was designed to be driven by four men turning a flywheel. The latter operated fan-like valves working in the orifices under each bow, thereby drawing in water, which afterward was forced out in jets by means of pistons also operated by the flywheels. The boat was trimmed by means of weights moved along the tramway shown at each side. The conning tower was telescopic, so that when diving far below the surface, where the pressure of the water would be too heavy on the glass windows, the tower could be collapsed. Unfortunately, the name of this early inventor has been lost.



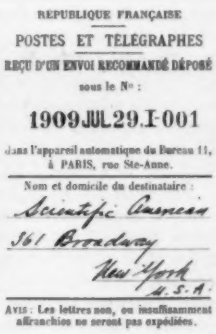
Model built early in the last century. Cover of the model removed to show the mechanism within.

AN EARLY TYPE OF SUBMARINE BOAT.

COIN-OPERATED DEVICE FOR REGISTERING LETTERS.

In one of the city post offices in Paris there is an apparatus which automatically registers letters, and issues a receipt for the sender of the letter. The apparatus is arranged to receive the French nickel or 25-centime piece. Advantage is taken of the fact that it is slightly magnetic, for in passing down the coin chute it is obliged to leap a gap and is prevented from dropping through by means of a magnet. A counterfeit of iron cannot pass the gap because it would be lifted up by the magnet, while non-magnetic coins would fall through. The letter slot does not open until after the coin is placed in the machine, and the receipt is not issued until after the letter is placed in the machine. The receipt, in the form of a ticket, is dated and stamped by turning the crank at the side of the apparatus. The whole operation is performed in less than five seconds, and is calculated to do away with the long line of waiting applicants at the usual registering windows. The apparatus can also be placed in banks or stores, where there is no danger of its being stolen, thus relieving the pressure at the regular post office.

The apparatus used in a Paris post office.



REPUBLIQUE FRANÇAISE

POSTES ET TÉLÉGRAPHES

REÇU D'UN ENVOI RECOMMANDÉ DÉPOSÉ sous le N° :

1909 JUL 29 I 001

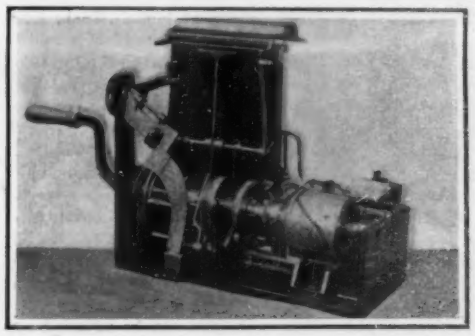
dans l'appareil automatique du Bureau 11, à PARIS, rue Ste-Anne.

Nom et domicile du destinataire :

Scientific American
361 Broadway
New York
U.S.A.

AVIS : Les lettres non, ou insuffisamment affranchies ne seront pas expédiées.

Facsimile of receipt issued by the machine.



Interior mechanism of the letter-registering apparatus.

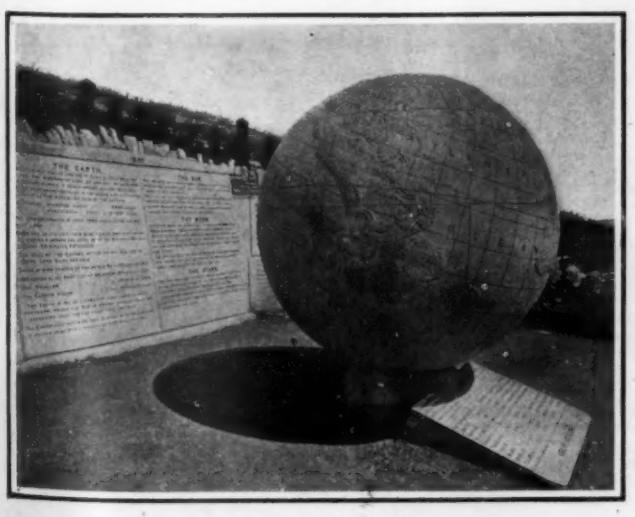
COIN-CONTROLLED APPARATUS FOR REGISTERING LETTERS.

SPRAY HELMET FOR FIREMEN.

Firemen frequently find it necessary to play the hose on their fellow firemen to protect them from the intense heat of the conflagration which they are fighting. Borrowing from this idea, an inventor has devised a helmet formed with a spray nozzle, which is connected to a small hose line. The water spouts out from the nozzle in all directions, causing a miniature cascade around the body of the fireman, enabling him to attack at close quarters fires that would be unendurable under ordinary conditions.

THE GREAT STONE GLOBE AT SWANAGE.

A peculiar monument is set up at Swanage, Dorset County, England. It consists of a globe 10 feet in diameter and weighing 40 tons. On it the continents and oceans are shown, the former in slight relief. Carved in the globe are the meridians, parallels of latitude, ecliptic, and tropics. The axis of the globe is inclined to correspond with the inclination of the earth's axis with respect to the ecliptic, but unfortunately the inclination is not in the right direction. Were the axis of the globe parallel with the axis of the earth, observers would be able to get a correct idea of day and night in different parts of the earth when the sun is shining on the stone globe. The monument is intended as a lesson in astronomy. Engraved on tablets of stone about the globe are data concerning dimensions of the earth, etc.



THE GREAT STONE GLOBE AT SWANAGE.

We have not heard the last of the "Mauretania's" great steaming powers and performances. Toward the end of the year, when the passenger season slackens down, the "Mauretania" will go into dry dock and be fitted with new propellers designed at Wallsend and specially intended to utilize the vessel's reserve of engine power which has not yet been called into full play. The propellers are similar to those which have recently been fitted to the "Lusitania," and with such good results that the vessel immediately broke the record. The "Mauretania," however, soon responded, and went one better, even with her old propellers. With the new ones, when fitted, it is naturally expected that she will do still better. Indeed, the builders and engineers of the "Mauretania" anticipate making her a 26-knot ship at the least, for her special advantages in design and engine power will be brought out to their full capacity.—The Mariner.

FIREMAN PROTECTED BY A SPRAY HELMET.

INDOOR BED TENTS.

BY KATHERINE LOUISE SMITH.

Fresh air at night and plenty of it is the cry that is going up among those who are determined to subdue the "Great White Plague," and with these persons it has become more than a fad, a necessity. Those who have resolved to abstain from kissing even their nearest and best, are now either seeking some practical method of sleeping out of doors, or planning some device whereby a good supply of fresh air may be obtained in warm bedrooms. Many persons are building screened porch bedrooms just outside of the sleeping rooms, where they can sleep in the patent sleeping bags that leave only the head exposed and that come with pockets for holding the hands. These persons dress and undress indoors, and jump into their twenty-dollar sleeping bag after adjusting a warm hood and muffler. But though the muffler can be drawn over the head so that only the eyes are exposed, and though it is made of heavy wool and elastic, there is in this outdoor sleeping bag danger of catching cold between the warm room and the outside bed.

So these fresh-air enthusiasts are casting about for some method that shall keep the body warm, the head exposed to the fresh air, and the bed adjusted in such a way that undressing and passing to the bed can be conducted in a warm room. To fill this need several devices have been invented, but they all fall under two heads—one where the person sleeps with his head out of the window, and the other where the bed is rolled to the open window, and a tent employed to drop over the sleeper's bed.

The cost of the ordinary window bed is moderate. It can easily be made by any carpenter, as it is constructed of an ordinary hospital bed with the legs adjusted eighteen inches from the end. These are just long enough to raise the bed so it can go over the sill. The head of the bed at night is thrust through the window, the sleeper creeps into the bed with his head outside the window and draws an awning down over his head, which protects him from inclement weather and at the same time does not exclude the air. A wide strip of felt is fastened to the lower sash of the window, to keep the air out of the room. In this way the sleeper has his head outdoors and his body under the bed clothes in a warm, heated room. There are, however, two objections to this bed, though it is so simple it can be made at home. These are that in cases where it protrudes through a window above the first floor, there is often the uncomfortable sensation that one may fall, and the other is that the bed shows from the outside of the dwelling.

For these reasons many persons are using the new fresh-air tents which are fastened inside the window. While several varieties are made, they all involve similar principles of construction, and they have the merit of not being conspicuous. In using the window tent, the side of the bed near the top is placed next to the open window. The tent, which is made of heavy canvas or awning cloth, comes down from the inside of the window over the side of the bed and over the pillow. It reaches to the middle sash, and can be adjusted by tightening a screw, and is capable of being moved from one window to another. With the head once under the tent, one can actually breathe the fresh air from the window, while the rest of the body is in the bed covered by the bed clothes and in a warm room.

These tents have become popular, for they are large enough so that the face can be close to the window or on the pillow and three feet back. A little celluloid window in the side of the tent next to the room allows the user to look out and to converse with those

(*Continued on page 423.*)

AN EMERGENCY OXYGEN CUP FOR MINERS.

BY FREDERIC B. HYDE.

Clarence Hall, explosives expert for the government, has just announced the invention of a safety device which, had it been in use a few weeks ago, might have saved hundreds of lives at the mine of the St. Paul Coal Company at Cherry, Ill. The device is a simple appliance, which generates sufficient oxygen to sustain life for a half hour or so under any conditions of atmosphere. Had the miners who died in the recent disaster been supplied with this apparatus, the densest of smoke or an atmospheric condition entirely devoid of oxygen would have killed them. They would have to remain been enabled the supply of alive until exhausted. oxygen was invented oxygen generator guarantees a lease of life for a time ranging from a half an hour to hour is fighting while a man his open air or way to the coming of awaiting the invention rescuers. The Mr. Hall was made by government while in the The manner in which inventor hit upon the idea of supplying oxygen to the entombed miner was casual in the extreme. Mr. Hall was lighting the lamp of an automobile, when the thought occurred to him of generating oxygen as the gases of the lamp were generated, and supplying that oxygen to miners to breathe when the air of the mine had become so contaminated with poisonous gases and smoke as to spell immediate death. Accordingly he made a device which consists of a water chamber, and below it a compartment filled with sodium peroxide. In an emergency, a stopcock is touched, and the water comes in contact with the chemical. The oxygen is generated. This is passed through the water, which cools it. Then it passes to the mouth and nose by means of a mask, such as is fitted to the face when gas is ordinarily administered by a dentist. Thus may oxygen be supplied that will keep a man going for half an hour while he fights his way out of a mine filled with gas or smoke.

MINER'S EMERGENCY OXYGEN OUTFIT.

Mr. Hall as a representative of the government studied many of the great disasters in mines that have occurred in recent years. At Mononga, where more than three hundred men lost their lives in December, 1907, he found that the vast majority of the men had died by slow suffocation long after the explosion. Many of these had crawled for great distances on their hands and knees, for the miner knows that the best air is near the ground. Their trousers were worn through at the knees, and their blood marked their trails. Their fingers were worn through to the bone from crawling.

Of all men who die in mines, ninety per cent meet death through suffocation. There are in the United States 700,000 men who work in coal mines. Many of these are daily subjected to the danger of suffocation. Every year 4,000 of them go to their deaths in this way. The ordinary safety devices are expensive. The men cannot have them always at hand, even if they could afford the expense.

The new device can be slipped into the coat pocket, and kept with the coat and lunch basket, always within reach.

Mr. Hall is in charge of the explosives station in Pittsburg, recently described in the SCIENTIFIC AMERICAN SUPPLEMENT. That station, it will be remembered, has a large chamber in which all sorts of poisonous gases may be confined and into which men are sent to demonstrate various appliances. Various kinds of oxygen helmets which will keep a man going for two hours were tried out here.

In this demonstration chamber Mr. Hall burned excelsior in the chamber until the smoke was so thick that the eye could not see four inches through it. Then he donned his oxygen-producing device and went in. He remained here quite comfortably for fifteen minutes. Then the smoke pained his eyes and drove him out. The device continued to generate oxygen, and other men entered the chamber with entire safety for more than half an hour.

A New Chromatic Circle.

The principal purpose of a chromatic circle is to show the true complementary color corresponding to any given tint. Rosenstiehl has attempted to correct the old error of regarding red and green, yellow and violet, blue and orange, as pairs of complementary colors. These false notions were introduced by Robert Waring Darwin at the close of the eighteenth century. They have been perpetuated by the chromatic circle used in the Gobelins tapestry manufactory and popularized by a lithographic copy of that circle, made in 1861, which is the only document at the disposal of French artist-artisans.

Rosenstiehl's experiments show: First, that the true complementaries of red and orange are not green and blue, but two tints near together in the green-blue region; second, that the complementary of yellow is not violet, but blue; third, that violet is the true complementary of green. The differences between the true complementaries and the false complementaries of Darwin are sufficiently great to warrant the construction of a new chromatic circle. Rosenstiehl's circle comprises twenty-four colors, which form twelve exactly complementary pairs. A neutral gray is produced by the rotation of a disk, half of which is covered with each color of any pair of complementaries, and all the grays thus obtained are very nearly identical. This condition, very difficult to realize in practice, implies not only equal intensities of the two colors of a pair, but sensibly equal intensities of all the colors. The result is in accordance with the Young-Helmholtz theory of the three fundamental color sensations.

The first bituminous coal mined in the United States, states the United States Geological Survey, was taken from what is usually termed the Richmond Basin, a small area in the southeastern portion of Virginia, near the city of Richmond. This basin is situated on the eastern margin of the Piedmont Plateau, 13 miles above tide water, on James River. It lies in Goochland, Henrico, Powhatan, and Chesterfield counties. The coal beds are much distorted, and the coal is of rather low grade when compared with that from other districts with which it has to come into competition. The occurrence of coal was known in the Richmond Basin as early as 1700, and in 1789 shipments were made to some of the Northern States. In 1822 the production amounted to 48,215 gross tons. At present what little coal is produced in this field is for local consumption only.

Storm awning raised, showing the sleeper in the indoor bed tent.

The storm awning outside the window.

The window sleeping tent in use.

Sleeping hood to protect the head from cold.

INDOOR BED TENTS.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

SEPARABLE FASTENER FOR BOOTS AND SHOES.—J. JEFFERSON, Salt Lake City, Utah. One of the purposes of this invention is to provide a simple, durable and effective means for drawing together the upper of a boot or shoe from the top of the vamp, and holding the upper closed over the front of the foot from the instep to the ankle.

COMB.—W. JACOBS, New Orleans, La. This invention is an improvement in combs, being adapted for embodiment in ladies' dressing and back combs as well as in pocket combs for use by men. The article presents an attractive appearance and combines with a comb, a mirror conveniently arranged for use as desired.

BUCKLE.—A. BIENENZUCHT, New York, N. Y. The buckle is more especially designed for use on men's trousers belts, and arranged with a particularly shaped hook on the tongue, for engagement with the fastening device used for closing the flies of the trousers, to hold the belt against upward movement on the trousers.

Electrical Devices.

ELECTRIC PROCESS FOR MAKING PICTURES.—B. D. AVIS, Jr., Wallace, W. Va. In the present patent the invention has reference to picture making, and the more particular purpose is the provision of a method and means for developing by electrolytic action a sensitive plate or analogous member which has been previously affected by the action of light.

VISUAL-SIGNAL APPARATUS.—R. EINBIGLER, New York, N. Y. The object here is to provide an apparatus for use in stock exchanges, factories, and mercantile establishments, and arranged for summoning a person to a meeting place by displaying the person's name, number or other indicating character, and also a station or place to which the person is directed for meeting the caller. It relates to apparatus such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Einbigler.

Of Interest to Farmers.

COMBINED FERTILIZER-DISTRIBUTER AND PLANTER.—F. W. DECKER, Brunswick, Ga. This device has the advantage over the ordinary type of planter in that the work in carrying out the operation is materially reduced. To this end a two wheeled machine is provided which is capable of delivering the fertilizer, drilling the ground preparatory to planting the seed, depositing the seed in the drill, and covering the seed after planting.

CORN-PLANTER.—C. W. LANHAM, Hustonville, Ky. This invention includes a special construction of main and auxiliary frames, the auxiliary frame being arranged at the front and pivotally supported. It carries the seed boxes and dropping mechanism. The various novel details characterize the adjusting and controlling means for the auxiliary frame and the parts carried thereby.

Of General Interest.

PAPER DECORATION.—A. SIMONSON, New York, N. Y. The invention pertains to decorations or festoons, and the intention is to provide a collapsible paper festoon formed of a plurality of layers of tissue paper or similar material, so cut and pasted as to be readily expanded for use as a decoration or garland.

INTERLOCKING BUILDING-BLOCK.—B. BENAS, New York, N. Y. The purpose of the inventor is to provide a new and improved interlocking building-block, for forming walls, partitions, floors and like structures, and arranged to interlock endwise and sidewise with adjacent blocks to form an exceedingly strong and durable structure.

SUBMARINE MINE.—A. P. BROOMELL, York, Pa. In the present patent the invention is an improvement in submarine mines or torpedoes and it has for an object the provision of a novel method of placing the torpedo at the desired depth below the surface of the water and a novel construction whereby the mine is so placed.

SIGN.—R. C. LAFFERTY, Clarksburg, W. Va. In this case the improvement is in signs, and while the invention has a general application and is capable of general use it is especially designed for use as a memorial sign by fraternal and other societies by which to display the names of the deceased members, and as a directory for office buildings.

DEVICE FOR LOWERING LIFE-BOATS.—C. J. CHRISTENSEN, New York, N. Y. This appliance is for use in controlling the lowering of life-boats from the davits of ships or vessels, etc., and the invention has for its purpose to facilitate the launching of the boat and avoid the wearing on the ropes incident to passing the ropes about cleats and permitting them to slip thereon under the weight of the life-boat, as is the usual practice.

APPARATUS FOR VIEWING STEREOSCOPIC OR OTHER PICTURES.—J. RICHARD, 25 Rue Mélingue, Paris, France. The apparatus comprises a horizontally movable carriage carrying a holder or magazine whereby each view in succession is brought into the plane of an upright frame which is capable of being moved vertically to bring one view at a time opposite the eye pieces of the instrument and thereafter return the view to the holder.

EASEL.—E. OLDENBUSCH, New York, N. Y. The invention refers more particularly to that type of easel adapted for use in supporting pictures, mirrors or the like, or for use as the back of small picture frames. One object is to simplify the construction of the hinge or connection between the back plate and the brace, whereby lost motion between the parts will be eliminated, yet they may be moved relatively to each other with minimum friction.

PROCESS OF RECOVERING TIN FROM WASTE.—A. NODON, 12 Rue de Mouils, Bordeaux, France. The object in this case is to provide an improved process for the recovery of tin from all kinds of tin lead waste, and more particularly from waste tinned plate, waste lead tin alloy and plated goods resulting from the manufacture of metal "tin capsules," "tin foil" and "tin tubes."

MOLD.—J. R. KAY, New York, N. Y. An object here is to furnish a mold for forming monolithic bodies of concrete, cement, and the like, which comprises removable and separable parts which can be easily mounted in position and taken down, and which is fashioned from standard structural members of metal or other material.

Hardware.

SAFETY-RAZOR-BLADE HOLDER.—D. CONEKIN, St. Petersburg, Fla. The invention is especially designed for use in stropping the blade and is so formed as to place the edge to be sharpened at the proper angle for the stropping operation. The holder is also made in one piece from a blank and presents a simple economically produced and effective holder for the purpose.

FARRIER'S IMPLEMENTS.—W. RAWALT, Blandinsville, Ill. This invention relates to an improvement in farrier's implements, by means of which a horse's hoof may be quickly and properly trimmed. The object is to provide a tool with a chisel and a movable hammer head, whereby the chisel may be more readily operated to trim the hoof.

VIBRATORY DISINTEGRATOR FOR GAS-PRODUCERS.—J. J. ASTOR, New York, N. Y. This invention relates to certain improvements in the manufacture of producer gas, and the object is to render practical the manufacture of producer gas from peat. The main essential feature involves the disintegrating action on the peat caused by the expansion of the gas occluded in the peat or held within its pores and interstices.

Heating and Lighting.

HEATING APPARATUS.—E. B. SMITH, Scotland, Ontario, Canada. The inventor's purpose is to provide in combination with a boiler or casing, a combustion chamber in connection with the exhaust of an internal combustion engine, for complete burning of the gases, and arranged near the bottom of the casing, an exhaust pipe leading from the chamber, having radiating means, as a coil, located adjacent to the chamber and means for introducing water within the casing surrounding the chamber, and radiating means.

LIGHT-CABINET.—C. F. MCCLURE and W. I. SHUMAN, Sullivan, Ill. The purpose of this invention is to produce a device which, upon the release of a trigger, will ignite a piece of absorbent cotton or similar material, and permit it to move by gravity along a wire or other suitable guiding means to a place where the illumination or combustion is desired.

LAMP-CHIMNEY.—G. H. LEE, Omaha, Neb. This invention relates particularly to means for centering the chimney of a lamp when it is set in position. An object is to provide a chimney having means which will facilitate its being guided to its proper position on the burner without necessitating the exercise of great care.

Household Utilities.

SELF-HEATING FLAT-IRONS.—C. S. KONIGSBERG and W. ALLEN, Oakland, Cal. This invention relates to irons adapted to generate the vapor or gas by which they are heated. One object is to produce an iron adapted to use denatured alcohol and the like for the heating agent, and having a supply tank formed in the lower portion of the handle of the iron.

QUILTING-FRAME.—S. S. RUSSELL, Columbia, S. C. This invention is an improvement in quilting-frames, and particularly in folding quilting-frames. Means provide for adjusting the frame at any angle; provide for securing the extension bars in any adjustment desired and permit them to slide in adjusting relatively to the main bars; and provide for operating to draw the uprights toward each other to securely brace the frame when in use, and also to separate the frame for convenience in storage and shipment.

Machines and Mechanical Devices.

PLUNGER MECHANISM FOR OIL-WELLS.—L. R. MCCARTHY and J. C. VROMAN, Spartansburg, Pa. This improvement pertains to the construction and operation of oil wells and the like, and concerns itself especially with the construction and operation of the plunger mechanism. The purpose is to provide a construction for controlling the pawls which lock the collar in the pipe.

SAW-CARRIAGE.—P. J. MURPHY, Alexandria, Va. This device, while permitting the easy manipulation of the saw-carriage, and the adjustment of the stick of wood to the proper length, prevents the saw from coming in contact with the operator's hand. The guard may be raised or lowered to any convenient height and retained in position to permit adjustment of the wood in place for sawing.

ETCHING-MACHINE.—H. SCHEDLER, New York, N. Y. This invention has reference to etching-machines of the type in which a plate or other article to be etched is exposed to the action of free acid in a trough. The invention causes the acid to produce a maximum effect and yet prevents the actual contact of the paddles with the surface to be etched.

GRIPPER FOR PRINTING-PRESSES.—M. W. ALGER and C. L. JACOBSON, Benton Harbor, Mich. The objects here are to provide adjustable fingers or grippers having horizontal adjustment; to provide fingers to hold the sheet being printed at the top and bottom of the sheet; to provide grippers to grasp at intervals the sheet to be printed; and to provide a mechanism simple and economical in construction and efficient in operation.

FILLING DEVICE.—J. PAPISH, New York, N. Y. The aim is to provide in this instance a device by means of which powders, crystals or other granular material can be expeditiously and easily introduced into small-necked bottles and the like, which requires little effort to operate it, and which fills the receptacles without spilling any of the material which is being introduced into the receptacle.

Prime Movers and Their Accessories.

SPARK-PLUG FOR INTERNAL-COMBUSTION ENGINES.—M. EYQUEM, 191 Boulevard Pereire, Paris, France. The invention relates to an improvement in a spark-plug with a tubular electrode and a decompression cock for the purpose of producing the cleaning of the plug not by means of the burned gases, but by fresh gases, that is to say, by air containing particles of gasolene. It is essentially characterized by the application to the plug of a device to cut off the ignition when the above cock of the spark-plug is opened.

Railways and Their Accessories.

CAR-DOOR FOR GRAIN, COAL, ETC.—R. R. REAVELEY, Fort William, Ontario, Canada. The construction embodies two doors hinged at the side edges to swing outwardly and forming, when closed, a substantially triangular opening, with the point of the opening at the bottom, a third door for closing the opening, hinged at the top to swing inwardly, and with the two doors removable from their hinges to swing to the outside of the car below the floor or carried within the car to positions removed from the door opening, and the third door removable to the top of the car.

CAR-FENDER.—T. J. KILLEEN, Portland, Ore. The purpose of this inventor is to provide novel details of construction for a fender, particularly well adapted for use on a street car, and that afford a strong, automatically-operating car-fender, which, when in position on a car, will positively pick up and support a person struck by the car without doing serious injury thereto.

ELECTROMAGNETIC TRACTION SYSTEM.—G. L. STANBRO, and A. D. WAGNER, Norfolk, Va. The object of the improvement is to provide a surface contact railway system which will have all the advantages of such a system and adapted for street service in cities as well as suburban traffic. Heretofore such systems have not been successful, being only applicable to short lengths of track in factory yards and the like.

SEAL-LOCK.—E. L. PITTS, Yuma, Ariz. Ter. In this instance the improvement is in seal record devices. The object of the invention is to provide a device for use on railroad freight cars, registered mail sacks, etc., whereby a continuous and permanent record of the times the car is opened and closed may be obtained.

Pertaining to Recreation.

FISH-HOOK.—W. E. KOCH, Whitehall, N. Y. The invention relates to hooks of the gang type, such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Koch. The aim is to provide a hook arranged to dispense with the lead weight on the main hook, and to counterbalance the hook with a view to securely holding the live bait floating in a natural position, and to keep the main hook and gang hooks in proper relation to each other.

Pertaining to Vehicles.

LOG-WAGON.—W. M. NORRIS, Edwards, Miss. Log-wagons require to have great strength and durability, along with maximum lightness and easy draft, besides being adapted to turn in a comparatively small circle. Eight-wheel wagons are preferable, but they have certain objections or defects which this invention removes by improved construction, arrangement and combination of the parts.

WAGON-DUMP.—E. EWEL, Grand Island, and S. L. CLEMENT, North Loup, Neb. This improvement is particularly adapted for side dump wagons, and means are provided whereby the main chute will receive and support the wagon body when the latter is in dumping position, and means for holding the chute at such time in discharging position and for releasing it from such position after the load is dumped.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

The full name and address must accompany all letters, or no attention will be paid thereto. This is solely for our information. *All* queries are answered by mail, and a *few* of the selected answers are afterward published in the paper. We cannot undertake to furnish information on matters of personal interest, without reasonable compensation. To answer questions which are not of general interest usually costs us from $2.00 to $3.00 each upward, and this sum should invariably be remitted in such cases. When there are questions involving building or other construction, or when calculations must be made, an estimate of the cost will be furnished upon request. We cannot give answers to examination papers, or decide wagers, nor can we undertake to solve mathematical problems of any description whatsoever. Do not use postal cards.

Queries from this vicinity not answered within fourteen days should be repeated in full. Queries from points more remote will require a longer time.

We do not make chemical analyses; but we are always pleased to give the names of minerals which are submitted to us, when it is possible for us to do so. The minerals should be sent marked distinctly with the name of the sender, and should be sent fully prepaid.

Buyers wishing to purchase any article not advertised in our columns will be supplied with the addresses of the houses manufacturing or carrying the same, as soon as possible, or if we are unable to do so, their queries can be advertised in our special classified column.

Any books on any scientific or technical subject can be furnished. We solicit requests for quotations. The SCIENTIFIC AMERICAN SUPPLEMENTS referred to are mailed for ten cents each. Book and SUPPLEMENT catalogues will be sent free on request. A careful reading of these "Hints to Correspondents" will prevent any misconception as to the uses and will prevent abuses of this column.

(12148) R. H. A. says: I tried the experiment of renewing old dry cells, and proved to be a failure, which was on page 300 of the October 23rd issue. The chemical did not want to absorb, and took two days before I was able to get the right quantity into the battery, and when sealed up tested about 7 amperes. Will you please tell me how I may overcome this trouble and just how to do it? A. We have nothing better to offer for the renewing of dry cells than you already have tried. It is not worth the while to renew these cells. The liquid is very slowly absorbed, and the cell is already full of crystals from the last charge, which are the result of the action and which will not dissolve in the liquid which you put into the cell. For these reasons one does not get much current from a renewed dry cell. We publish all such processes, for the reason that many amateurs like to experiment with any such process, and they get much pleasure out of the work. Probably your result was as good as could be expected.

(12149) F. M. R. says: Is it ever possible that a stone will never reach the bottom of water in mid-ocean which may be, let us say, 25 miles deep? That is, is water ever so compressed that a stone will displace a volume of water which at this great pressure is equal to the weight of that stone? To state the same question in a different way: Would a submarine diver require heavier shoes to go down 100 feet than he would to go down 20 feet? Allowing, of course, for the added buoyancy of the longer air pipe. A. Water is one of the most incompressible of materials, far more so than the hardest steel. It follows from this that a substance which is denser than water at the surface of the ocean will never become lighter than water as it sinks, or that water will never become as dense as this substance at any depth, since the substance will be compressed more by sinking in the water than the water has been at any level under the water. You will find a full discussion of this question in the following numbers of the SCIENTIFIC AMERICAN: Vol. 96, Nos. 9, 13, and 19, in Answers to Queries. We will send the three papers for 10 cents each.

(12150) E. D. says: Would you please tell me what weight of wire should be used on the fields of the simple electric motor described in "Experimental Science," Vol. I, page 497, for shunt winding, using single cotton-covered wire? Please state also the length of wire on each coil of the fields. A. We have no additional data for the simple electric motor beyond what is given in "Experimental Science," or in SUPPLEMENT No. 641, in which the plans for this motor were originally published. If you connect the motor in shunt, it will doubtless run with battery designed for it and described in SUPPLEMENT No. 792. We send all SUPPLEMENTS at 10 cents each. With this battery the current is graduated by varying the immersion of the plates, and thus economy of action is secured.

(12151) E. H. H. asks how a blue print can be changed to black. A. A blue-print can be changed to a black color by placing the print into the following solution: Borax, ¼ ounce, water 6 ounces. When blackened, wash the print, and place it into the following solution: Gallic acid ¼ ounce, tannic acid ¼ ounce, water 8 ounces. As soon as the color is attained, wash the print and dry. A second blue-print can be made from this, of course, reversed as to position of lines or figures, but by placing the back of the changed blue-print against the surface of sensitized blue-print paper a duplicate with blue lines can be obtained.

NEW BOOKS, ETC.

FUNDAMENTAL PRINCIPLES OF CHEMISTRY. An Introduction to All Textbooks of Chemistry. By Wilhelm Ostwald. Translation by Harry W. Morse. New York: Longmans, Green & Co., 1909. 8vo.; pp. 349.

Prof. Ostwald's name is one to conju with in almost every branch of science and in chemistry particularly. It would be difficult indeed to mention a chemist who has contributed more to the advancement of his science in our time, or one who occupies a more eminent position as a teacher. In this book Prof. Ostwald has presented with remarkable ingenuity and simplicity the actual fundamental principles of the science of chemistry, their meaning and connection, and stripped them so far as possible of irrelevant additions. The book may be regarded as an attempt to work out chemistry under the form of a rational scientific system without bringing in the properties of individual substances. Hence, it has been necessary to restate elementary principles in a new light, and to bring out many new connections in regions hitherto untouched. That is why this work will be found different in its treatment from any other work on chemistry that has ever been written. The pedagogic value of the preceding can be judged only by the instructor of chemistry. But to anyone familiar at all with chemistry, its merit must be apparent from an impartial consideration of the book.

A HAND BOOK OF PRACTICAL CALCULATION AND APPLICATION OF REINFORCED CONCRETE. Kahn System Standards. Compiled and published by the Engineering Department of the Trussed Concrete Steel Company. 12mo.; 126 pp.

The rapid growth of reinforced concrete construction makes necessary a hand book on design, similar to those in use for the ordinary classes of building material. The object of this hand book is to present to the designer tables and information in such form as to be made immediately available for use in actual designs, and at the same time to have these tables founded on scientific formulæ approved by our best engineering practice. The work as presented deals mainly with the Kahn trussed bar. The Kahn system of reinforced concrete, however, uses in its application several other types of reinforcement, including rib metal, hy-rib, cup bars, column hooping, rib lath, and rib studs.

HOW TO OBSERVE AND RECORD THE WEATHER.

(*Continued from page 412.*)

mounted very nearly horizontally. These two instruments are usually supported as they appear in Fig. 3.

The minimum is read and then "set" by raising it gently until the index slides to the surface of the alcohol (Fig. 5). The maximum must be lowered to a vertical position before it is read (Fig. 4). After this reading is taken and recorded, the thermometer is then "set" by gently swinging it up and down, until that amount of mercury is shaken back into the bulb that represents the difference in temperature between the maximum and the present, if any. When no more mercury can be returned to the bulb, the thermometer is allowed to hang vertically, and a second reading is taken. The mercury now gives the temperature at the time of reading; and this reading is recorded as "set maximum." In other words, the maximum thermometer serves in place of two thermometers. First, it records the highest temperatures during the twenty-four hours; and secondly, when it is set, it gives the temperature at 7 P. M.—the time of reading.

EXPOSURE.—The marked variation between the readings obtained from thermometers owned by private persons and Weather Bureau thermometers is due much more frequently to the difference in the manner of exposing them than to difference in quality, accuracy, or cost price. Thermometers exposed against buildings, on verandas, in windows, cannot often be trusted to give even approximately the true temperature of the atmosphere. For the air is not a stationary body, but is a continuously intertwisting, expanding, and contracting gas perpetually seeking an equilibrium, which is seldom even momentarily gained, than it is instantly lost. All gross inaccuracies attending exposure of thermometers are overcome by the shelter adopted by the Weather Bureau and provided to all observers (Fig. 9).

The outside dimensions are 42 inches long by 36 inches wide by 36 inches least height, and a second roof, 6 inches above, has two ends open. The air has free access to the interior, for the four sides of the shelter are louvered; that is, composed of shutters. These shutters overlap, and have a pitch which enables them to shed water, and intercept also the rays of the sun, even when level at sunrise or sunset.

Shelters ought to be placed in a large open space, or upon a house top or other high building, where the circulation of the air is unimpeded. Correct temperatures are recorded only when the air flows freely round the shelter as well as through it. When the shelter cannot be situated in an open area, it may be set up on the north side of a building, with a space not less than four inches intervening.

Sunshine does not give the average temperature of the air, but the highest; and so a thermometer, hung in the sun, falsifies or greatly exaggerates. If the temperature is 87, a thermometer in the sun will run up to 100 or more. The confiding observer, suddenly aware how hot it apparently is, grows faint from the imaginary heat, runs for a fan, and rapidly raises his bodily temperature by his vigorous gesticulations trying to cool himself.

Instruments that measure the depth of the fall of rain are neither well known by sight, nor is the method by which they record the rainfall very familiar.

Fig. 7 shows the essential parts of a rain gage, which are a receiver, a measuring tube, and an overflow. The rain is caught by the receiver, the bottom of which is funnel shaped, and falls into the measuring tube. Should the amount that falls be excessive, and more than fill the measuring tube, the excess overflows into the outer cylinder. The rain gage is designed to catch the precipitation of rain, and to facilitate the reading of the amount by mechanically magnifying the quantity. The diameter of a Weather Bureau rain gage receiver at the top is 8 inches; the diameter of the measuring tube is 2.53 inches. In consequence of this difference in area, the water in the measuring tube stands ten times deeper than if spread over the area of the receiver; so that a rainfall of one inch in the receiver stands ten inches in the measuring tube. The scale by which the water is measured is graduated in hundredths of an inch; but that inch on the scale is really ten inches long (Fig. 8).

In the normal temperate climate, there are only a few rains in a year when a reading of one inch is observed. A fall of rain amounting to two inches is uncommon; a precipitation recording three or more inches is the exceptional record of a decade or two. Some rains, attended by strong wind, vivid lightning, and apparently heavy downpouring of sheety rain, give a reading as low as twenty-five to sixty or seventy hundredths of an inch; while other rains, not so accompanied by electric phenomena and aerial disturbances, occasionally give a reading of an inch or more. Only an experienced observer is competent to make a fairly close guess of the amount of precipitation; and at best his guess is subject to the errors that so commonly invalidate all suppositions.

Snowfall is caught in the large cylin-

(*Continued on page 419.*)

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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Adding machine, C. Wales	940,758
Adding machines, keyboard locking mechanism for, C. N. McFarland	940,708
Adding machines, lock for numeral wheels for, N. White	940,766
Adding machines, ribbon feeding and reversing mechanism for, H. Kuntzler	940,814
Adjustable chair, R. Ramsey	940,824
Advertising device, C. H. Cullins	941,012
Agricultural implements, journal for, A. C. Ditmar	941,191
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Antislipping attachment, J. S. Gajewski	940,799
Anvil, G. E. Freeborn	940,798
Arm chair, E. P. Wanner	940,995
Auto-horse, C. E. Birky	941,301
Automatic switch, E. F. Bubb	941,227
Automobiles, radiator for, J. E. Lewis	940,976
Axles, reworking worn car, J. M. Hansen, 940,805,	940,806
Bag fastener, E. S. Erickson	941,016
Bale wiring mechanism, J. H. Sawyer	940,897
Bean separator, F. C. Britt	941,305
Bearing, roller center, J. F. O'Connor	940,819
Bearing, thrust, G. Rennerfelt	941,097
Bed pad, J. P. Duval	940,958
Belt tightener, D. R. & H. W. Blakeslee	941,226
Bench. See Piano bench.	
Binder, A. C. Hafely	941,142
Binder, loose leaf, J. S. McComb	940,706
Binder, loose leaf, M. von Hertzberg	941,198
Binders, extensible post for loose leaf, J. S. McComb	940,705
Binders, support for loose leaf, J. S. McComb	940,707
Blade holding means, H. L. Barton	940,778
Blower or pump, F. J. Miner	940,984
Boiler, D. Hanlon	940,684
Book, loose leaf, L. E. Marsh	941,084
Bookcase, L. Nelson	941,168
Boot, G. Watkins	941,116
Bottle, P. A. Thorin	940,993
Bottle, non-refillable, F. W. Herbert	940,687
Bottle, non-refillable, L. C. Foster	940,962
Bottle, non-refillable, J. Berg	941,184
Bottle stopper, W. E. Gaston	940,926
Bottles and similar vessels, machine for cleansing, Strasburger & Granges	940,948
Box, R. W. Carroll	940,922
Box, D. H. Glover	941,140
Box, A. E. Klingenberg	941,323
Box handling attachment for shelves, Jones & Nicholes	940,878
Brake shoe key, C. N. Smith	941,107
Bread cutting machine, M. J. Ferren	941,065
Bricklaying machine, M. Falcone	941,137
Briquetting machine, Ellsworth & Dowell	940,959
Brush holder, antiseptic tooth, W. D. Jones	941,200
Brush ware, J. A. Burnside	941,306
Buckle, belt, A. M. Gardner	941,242
Buckle for waist belts, J. A. Dubois	941,136
Buckle, lever, C. E. Smith	940,829
Building blocks, machine for making hollow, Scott & Dilgard	940,741
Butter treating apparatus, Nulf & Jackson	940,716
By-pass, E. Burhorn	940,920
Cabbages, machine for splitting and core slicing, L. Lecheler	941,262
Cabinet, folding and sliding safe, I. J. Wing	941,052
Cabinet, towel, R. T. Parisen	940,717
Cable grip, J. F. Sallows	940,732
Cable hanger, C. L. Peirce, Jr	941,039
Calculating implement, E. J. Brandt	941,004
Cameras, roller blind for photographic, E. Brauburger	941,126
Can body forming machine, W. W. Jones	941,076
Can heading machine, L. C. Krummel	941,346
Can opener, W. G. Kircher	940,932
Canceling machine, ticket, Fisk & Seely	940,681
Candelabrum, O. H. von Guelpen	941,213
Candle end forming machine, C. B. Manbeck	941,083
Canvas carrier, artist's wet, R. P. Tolman	941,212
Car, W. H. Son	940,202
Car brake operating mechanism, C. A. Williamson	941,219
Car door, grain, H. W. Richards	941,099
Car door hanger, Frame & Harrington	941,069
Car, dump, J. B. Rhodes	940,893
Car fender, Youngberg & Parnall	940,772
Car, railway, H. S. Hart	941,249
Car, steel box, Frame & Harrington	941,067
Car ventilator, railway, J. E. Ward	941,290
Car window ventilator, D. W. Snow	940,946
Cars, passenger controlled register for street, O. Speckenbach	941,108
Card attachment, J. E. Ralph	941,273
Carriage and wagon checking attachment, W. F. Young	940,771
Carrier, C. B. Willenberg	940,768
Carriers, automatic dumping device for elevated, T. O. Werner	940,760
Cash register, W. J. McKee	940,816
Caster, G. W. Bent	940,780
Caster, self-adjusting, T. C. Luce	941,082
Cat guard, Z. D. Underhill	940,755
Causticizing tank, E. F. Parker	941,036
Cement washtub mold, T. V. Galasse	941,139
Centrifugal extractor, W. Bartholomew	940,662
Chair, C. J. Travers	940,907
Chair, E. H. Milner	941,160
Chair fan attachment, L. Hildreth	940,688
Chairs, binding means for, A. G. Walter	940,759
Checkrein, J. S. Mirgan	940,886
Churn, F. A. Grant	941,318
Circuit breaker, automatic, Lawrence & Torchio	940,881
Clamp and rail brace, Griffin & Muth	940,964
Clasp fastener, M. Pugatsky et al	941,096
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Cleansing compound, J. A. Lester	941,155
Clock, alarm, W. E. Porter	941,042
Clothes line prop, W. Hetherington	940,875
Clothes pounder, E. W. Lynch	940,699
Clothes reel, R. W. Robinson	940,729
Clutch, Hovey & Stebbins	940,970
Clutch, F. P. Huyck	941,349
Clutch, friction, P. Evans	940,679
Coasting record device, Hedley & Doyle	940,810
Coating machines, feeding and dusting device for, M. Schenck	940,737
Cock, compression, C. S. Frishmuth	941,316
Coffee cleaning and grading machine, E. C. Smith	940,989
Coin-controlled apparatus, A. G. Kennel	940,973
Colter attachment, plow, C. Hightower	941,252
Comb attachment, F. N. Plamondon	940,890

Combination lock, J. J. Murphy	941,028
Combination lock, W. Fox	941,241
Concrete block machine, L. B. Larsen	940,935
Concrete building blocks, bond for two-membered, L. B. Larsen	941,080
Concrete pile for pier and foundation construction, reinforced, C. E. Lamburth	941,078
Conduits, receptacle or the like for, Lutz & Sibley	941,156
Confectionery machine, O. F. Granlund	941,070
Container, O. A. Borden	941,303
Conveyer, H. B. & J. A. Sauerman	941,045
Cooker, egg, D. H. Moore	941,265
Cooking utensil, L. Carr	940,672
Cooking vessel cover, ventilated, C. S. Phillips	941,041
Cooling box, H. J. Kuck	941,077
Coop, poultry, A. M. Benzing	941,300
Cotton chopper, J. B. Thompson	940,906
Cotton chopper, G. W. Rice	941,098
Cotton chopper, W. A. Crow	941,230
Cotton picker, W. W. Bays	941,055
Couch, convertible chair, M. Brown	941,186
Counter, article, A. Bretschneider	940,851
Coupling, G. B. McBean	941,031
Crate, foldable shipping, T. F. Umfries	940,754
Crate, folding, F. L. Mary	941,202
Cream separating apparatus, J. W. Heathcote	940,686
Cross tie and rail fastener, A. Birochik	941,225
Cup, M. Dishman	941,236
Curtain bracket, combination, E. D. Parker	940,829
Curtain pole support, Eells & McKelvey	940,711
Curtain rod leader, C. W. Boulton	940,668
Cutter head, rotary, C. O. Porter	940,940
Damper for furnace or stove pipes, R. Rouse, Jr.	940,942
Dental plate, D. D. Hyman	941,140
Designating, recording, and registering mechanism, E. J. Brandt	941,005
Differential mechanism, D. E. Ross	941,101
Dike building apparatus and process, J. W. Sykes	941,051
Disinfecting apparatus, W. M. Byer	940,921
Display rack, fruit and vegetable, C. C. Hart	940,807
Distillation of bituminous coal or similar carbonaceous substances, T. Parker	941,352
Ditching and earth distributing mechanism, J. W. Sykes	941,050
Ditching machine, J. B. Hill	941,145
Divided bolt, A. Schlussler	940,739
Door, J. H. Pearson	941,094
Door, combination, A. L. Penwell	940,719
Door fastener, A. Berdan	941,057
Door hanger, E. C. Pitcher	941,095
Door lock, automatic knob-operated, G. C. Manning	941,327
Door, metallic, Frame & Harrington	941,068
Door operating mechanism, E. D. Curtis	941,132
Door track and hanger, A. Wulff	940,770
Doors, fastening device for emergency exit, Willison & Williams	941,000
Dough and like materials, machine for treating, G. S. Baker	941,296
Dough forming machine, G. H. Petri	941,338
Drag, J. & A. Bladholm	941,340
Drier, K. Tauji	940,908
Dry room conveyer, combined, W. Bartholomew	940,661
Drilling apparatus, tubular drill stem for hydraulic rotary, L. C. Sands	940,733
Dust collector and separator, A. T. Sheward	940,827
Dye and making same, azo, C. O. Muller	941,088
Dye and making same, vat, H. Kraft	941,152
Dyeing apparatus, yarn, Geissler & Wagner	940,868
Egg opener, T. Cowburn	940,790
Electric cut-out, T. E. Murray	941,165
Electric machine, dynamo, Lamme & Feicht	940,698
Electric machine elements, lining for slots of dynamo, Young & Heitmann	941,181
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Electric switch, W. A. Morse	941,266
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Electrical conducting system, W. E. Athearn	940,655
Electrical distribution system, W. A. Turbayne	941,113
Electrical receptacle, F. J. Russell	941,276
Electrolyte for use in electric batteries, W. J. L. Sandy	940,734
Elevator safety device, automatic, J. T. Dempsey	940,792
Embroidering machine, R. Zahn	941,123
Emergency brake, Norton & Reid	941,335
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Engine ignition system, internal combustion, C. B. Askew	941,124
Engines, causing self-ignition in explosive, A. O. Haney	940,872
Engraving or duplicating machine, A. W. Roovers	940,730
Envelop, C. B. Kilby	940,974
Envelop, J. Mazalin	941,328
Envelop, F. M. Leisure	941,350
Envelop, safety, P. A. Thorin	941,288
Equalizer, front fork, S. J. Buckland	940,783
Excavator, A. Toupin	940,752
Exhibiting apparatus, C. D. Whittredge	941,118
Expansion tank with liquid relief, H. A. R. Dietrich	941,235
Extinguisher, A. D. Swoger	940,832
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Fabrics, machine for turning and winding tubular, T. H. Murphy	941,164
Fare box, J. Quinn	940,727
Fastener, separable, S. A. Asquith	940,917
Faucet, T. O. Thompson	941,210
Faucet, bottle filling, D. D. Polley	941,268
Feed regulator, G. D. Scheiffler	940,943
Feeding mechanism, B. M. W. Hanson	940,929
Fence lock, G. H. Farmilo	940,680
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File cabinet, bill, J. Miller	941,025
Filing cabinet, J. Dannheiser	941,133
Film pack, flat, J. G. Schneider	941,103
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Filters, indicator device for reservoir, F. N. Comet	941,061
Fire escape, Green & Brasket	941,246
Fire extinguisher valve, A. Blauvelt	940,953
Fire protection and signal system, J. E. Shepherd	941,048
Firearm lock, T. Kofler	941,200
Firearm, magazine, H. W. De Jarnatt	940,791
Firearms, magazine cut-off for repeating, J. H. Wheeler	940,764
Flanged pipe, C. Gordon	940,870
Flask, L. W. Daman	940,858
Floor jack, A. Junker	940,695
Flue expander and beader, J. L. Didier	941,190
Fluid testing apparatus, H. B. Bishop	940,850
Flushing apparatus for water closet bowls or hoppers, W. E. Snaman	941,283
Flying machine, A. H. Friedel	940,886
Folding box, J. W. Putnam	940,941
Folding box, C. F. Jenkins	941,256, 941,257
Folding box or shipping case, Doble & Wheaton	941,013
Form, garment, E. Levin	941,022
Fruit picker, J. R. Johnson	941,258
Fuel producer, Shepard & Wickham	940,945
Furnace, E. V. Coulston	940,789
Furnace grate, W. H. Baush	940,849
Fuse, F. G. Jones	941,020
Gage glass, C. L. Dickerson	940,860
Game apparatus, A. B. Clemens	940,855
Game apparatus, B. Hamilton	941,194
Garment hanger, combination, A. A. Vanderford	941,115
Garment, lady's, A. W. Powell	940,987
Garment supporter, W. A. Selbel	941,105
Gas apparatus, water, S. J. Dickey	940,925
Gas engine, R. G. & V. E. Nelson	941,169
Gas plants, supply tank and carbureter for, F. B. Alldredge	940,916
Gas producer, R. B. Kernohan	940,696
Gaseous mixtures, apparatus for separating the constituent elements of, E. Nazza	940,885
Gases and vapors, apparatus for separating particles of liquid from, M. Steger	940,947
Gate and door fastener, F. J. S. Miely	941,203

der by removing the funnel and tube. It is measured by first melting the snow, then pouring the water into the measuring tube, and ascertaining the quantity exactly as for rain. The measuring tube may be filled to the brim with warm water, and this poured on the snow, which will soon melt. The measuring tube is filled once, and then emptied; the remainder of the fluid represents the precipitation from the snowfall. A third way of arriving at the snowfall is to cut a section of snow by turning the receiver down over it where the snow is level and not blown away nor drifted by wind. The section is then carefully lifted by a small shovel or paddle board, melted, and measured. To learn approximately the depth of water in a snowfall, one-tenth of the thickness of the layer of snow is taken, ten inches of snow being estimated to contain one inch of water; but this gives too little if snow is wet.

EXPOSURE OF RAIN GAGE.—It will not do to set up a rain gage anywhere and expect to get exact measurements of precipitation, for the rainfall varies as much as thirty per cent below the normal according to location, owing to the action of wind currents, to the intervention of buildings, trees, or fences unduly near the gage. A roof must be at least sixty feet square, and level, ere the wind action on the side walls of a building is eliminated from influencing the rain gage in the center.

Wind brakes are desirable around an instrument; the rule being that obstructions must be removed a distance equal to their height. For this reason, a fence surrounding a rain gage, four feet high and four feet away, will favorably overcome the wind, so that on a large open space more water will be caught by the receiver. For it is to be understood that the fluctuations of amounts caught between two rain gages near each other is to be ascribed to the wind. Consequently, rain gages protected at a suitable distance from the violence of the wind by bushes, fences, trees, or buildings catch more water than unprotected rain gages. This may be attributed partly to side currents whirling near the ground, and partly to the splashing of the drops of rain if they strike the gage through these intertwisting ground currents (Fig. 10).

RIVER GAGES.—A river gage is a scale by which the height of water in a stream may be measured; and the stage of water, whether low or high, may be observed and recorded. The Weather Bureau endeavors to get reliable data of all streams that affect inland navigation. It so happens that it is sometimes important to receive reports of the condition of the upper reaches of certain tributaries that are themselves unnavigable, but whose flooding may seriously imperil towns below, and materially swell the high water of the navigable rivers into which they empty.

A river gage can be a simple contrivance, and answer all practical purposes for creeks and small rivers. A graduated board extending below the lowest known level, fastened against a bridge abutment, is unexcelled, if it be convenient to read it at all times. The stone facing of an abutment itself may be smoothed and graduated, and be made to answer almost as well as an elaborate device (Fig. 6).

Strips of brass or of lead, securely inset or marks burned in, will do for graduations. The "feet" should be plainly numbered, lest in reading the gage, when the water is very high, a mistake is made. Great care must be exercised to graduate the sloping timbers of this style of gage; for which nothing less than an engineer's level is sufficiently accurate for governmental requirements. The illustration explains how this may be done with a carpenter's level.

The book in which the observations are written is called the "Meteorological Record." The pages of this record are ruled for date, maximum, minimum, range, set maximum, precipitation, prevailing direc-

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tion of the wind, character of the day, and remarks.

Opposite the date is set down the reading of the highest and lowest temperatures; the difference is placed in the range column; the set maximum, as explained above, is the temperature at the time of reading. The time of beginning and the time of ending, with the amount of precipitation, is next entered in the record. The prevailing direction of the

METEOROLOGICAL RECORD,
May, 1905 (at Sidney, Ohio).

Date.	Set Max. 7 P. M.	Maximum.	Minimum.	Range.	Precipitation. Time Beginning	Precipitation. Time Ending	Amount.	Wind.	Char. Day.	Remarks.
1	53	59	35	24	....	....	....	S.	Clear.	...
2	73	89	46	57	....	....	....	S.	Clear.	....
3	75	92	60	32	....	....	....	S.	Clear.	....
4	73	87	62	25	5:40 P. M.	....	0.07	S.	Clear.	....
5	....	....	....	....	D. N.*	7:25 A. M.	0.13	S. W.	Cloudy.	...

* During night.

(Copy of Original.)

wind is that direction from which the wind blows the most hours of the twenty-four. The character of the day refers to the sky, whether it is cloudy, partly cloudy, or clear. A sky of 70 per cent freedom, or more, from clouds is said to be "clear"; 50 to 60 per cent without clouds, is called "partly cloudy"; none to 20 per cent without clouds is accounted "cloudy." In the column for remarks may be entered notes descriptive of unusual phenomena, such as severe storms, meteors, killing frosts, remarkable depths of snow, floods in the streams of the vicinity, aurora borealis, deaths by lightning. To make the record valuable by the uniformity of its keeping, it is highly important that the readings be taken at the same hour each day, preferably at 7 P. M., seventy-fifth meridian time. A column for the water gage may be added, if the levels of a stream are to be observed.

TESTING THE MAN-ENGINE.

(*Continued from page 413.*)

is gaged by another attachment electrically joined to this clock. At the height of the subject's shoulder are arranged, upon a bar, two small hinged uprights. His hand is placed against one of these little posts and he is told to move it as quickly as possible in the direction of the other and to knock both of them down in the least possible time. The clock measures the time interval between the fall of the two uprights, and thus it is possible to time the swiftest movement of the arm in passing through a yard or foot of space. Men are found to be twice as rapid in this movement as women; Indians much slower than whites; negroes more constant than whites in rate of movement.

Another ingenious man-engine gage is a cylinder revolved by clockwork and covered with paper against which rests a marking point moved by air pressure exerted through a tube connecting with any number of attachments. This apparatus is used largely in comparing the workings of the body while under normal conditions and during hard thinking or strong emotion, or after great intellectual or physical effort. Thus when an

(*Continued on page 421.*)

Permutation lock, J. E. Le Myre	940,936
Phase adjustment, W. E. Sumpner	940,747
Photographic shutter, C. F. J. Niss	940,714
Piano bench, A. B. Hanson	940,804
Picture frame making machine, J. Mueller	941,331
Pictures, pieces of music, and other performances, apparatus for producing audible moving, F. E. Thorneyer	941,211
Pie rimmer, A. J. Perron	941,337
Pincers, lasting, W. Huck	941,254
Pipe, J. A. Irving	941,019
Pipe, L. Morris	941,027
Pipe coupling, automatic, Doane & Ceeder	940,678
Pipes, etc., coupling for train, J. E. Forsyth	941,066
Pipes, flanging, C. D. Murdock	940,702
Plate attachment, pie, H. Isaacs	941,074
Plates, making half-tone, J. Hartnet, Jr.	940,808
Pliers, wire skinning, G. W. Goodridge	941,192
Plow, B. T. Bethune	941,224
Plow, motor, W. T. Bennett	941,299
Plows, weed turning attachment for, T. J. Baxter	941,298
Plumbing trap, J. T. Costello	941,062
Plunger head or valve, J. E. Shutt	940,900
Pneumatic sweeper, S. Markstein	941,347
Potato cutter, J. A. Wise	941,001
Potato vine cutter, G. P. Gregory	941,247
Power controller for machines, Wilcox & Bartholomew	940,767
Power transmission apparatus, D. E. Selders	941,280
Power transmission mechanism, C. Kilroy	940,880
Power transmitting apparatus, R. A. La Pointe	941,154
Power transmitting mechanism, C. H. Draper	940,861
Preserving edible substances, A. J. Baldwin	940,848
Press, J. C. Fiddyment	940,961
Pressure generating, controlling, and applying device, hydraulic, J. W. Nelson	941,167
Pressure regulator, W. F. Krichbaum	941,153
Printer's galley, J. L. Lee	940,975
Printing machine, Sloane & Owsley	941,106
Printing press, A. J. Mottlau	941,162
Propeller, O. P. Smith	940,743
Pulley, split metal, E. Philips	940,720
Pulp screening machine, J. F. Fisher	941,017
Pump, N. McCarty	940,703, 940,704
Pump, W. T. McLean et al.	940,817
Pump, automatic air, E. Reed	940,892
Pump, multiple impeller, A. E. Guy	940,871
Pump, vacuum, G. H. Zschech	940,913
Rack for rolls of merchandise, C. J. Simonson	941,281
Rail connection, W. C. Bopp	940,954
Rail curve seat, J. E. Dougherty	941,312
Rail fastener, F. Persic	940,986
Rail fastener and bond, C. D. McAfee	941,332
Rail fastening device, Mason & Obe	941,264
Rail joint, G. H. Barbour	940,777
Rail joint, J. Schusher	941,279
Rail joint, insulated, G. W. Whiteman	941,175
Rail tie, C. Carrell	941,307
Rails, etc., instrument for measuring the cross section of, R. Barthelmes	941,297
Rails, treatment of steel, F. H. Daniels	941,134
Railway automatic safety appliance, W. G. Daring	941,233
Railway, cable, G. F. Roughan	940,825
Railway crossing gate, automatically operated, W. J. Cook	940,786
Railway frog, H. G. Elfborg	940,863, 940,864
Railway rail structure, E. S. Nethercut	940,818
Railway rail tie and brace, H. O. Wert	941,217
Railway safety appliance, J. T. Andrew	941,222
Railway signal, L. E. Garnett	940,800
Railway signaling apparatus, W. J. Cook	940,787
Railway signaling system, Dougal & Chambers	941,263
Railway switch, D. C. McCalib	941,089
Railway switch, G. D. Worley	941,220
Railway system, third-rail electric, C. Kozesnik	941,151
Railway tie, F. Schumann	940,740
Range finder, single observer, Barr & Stroud	941,125
Ratchet releasing mechanism, C. O. L. Cardell	941,188
Razor, safety, F. Cupelli	941,231
Reel. See Clothes reel.	
Refrigerator, J. H. Manon	940,700
Reinforced fabric, unwoven, Bayne & Subers	940,779
Repair device, adhesive, W. N. Shelton	941,047
Reversing mechanism, J. C. Ross	941,275
Ribbon feed mechanism, C. M. Crook	941,130
Rim holder, spare, B. B. Bradley	941,341
Road construction and repair, S. G. Howe	940,971
Rock drill, H. J. Hibschle	941,251
Roundabout, vertical, W. A. Sullivan	941,209
Sad iron, electrical, W. A. Braun	941,342
Saggar, W. E. Rivers	941,044
Sand ramming machine, H. P. Macdonald	941,023
Sash lock, Pearson & Lindquist	941,038
Sash lock, G. M. Blandford	941,059
Sash operating mechanism, S. E. Cibulas	941,343
Saw, drag, F. Hornquist	940,876
Saw hanger, L. D. Reece	940,728
Saw swaging and shaping device, T. W. Cross	941,131
Scale, C. M. Sturgis	941,208
Scale, platform, M. H. Winslow	941,119
Scraper, Bingaman & Miller	940,606
Screen holding device, wire, Smiston & German	941,282
Self-cleaning rake, F. W. Wieman	941,292
Sewing and embroidering machine, B. Corney	940,788
Sewing machine, T. G. Plant	940,724
Sewing machine channel moistening device, W. H. Hooper	940,691
Sewing machine channeling device, T. G. Plant	940,723
Sewing machine, lock stich, T. G. Plant	940,726
Sewing machine, shoe, T. G. Plant	940,725
Shaft, G. R. Moore	941,087
Sharpener, scraper, J. B. Ackermann	940,773
Shaving mug and brush casing, O. Lilles	940,883
Sheet metal bodies, apparatus for forming hollow, Adriance & Calleson	940,914
Shingle bracket, J. B. Demary	940,957
Shipping case or box, knockdown, W. H. Doble	941,014
Shoe, F. A. Critz, Jr.	940,856
Shoe polishing machine, F. Humphreville	941,345
Shoe rack, S. Hermann	940,812
Shoulder brace, J. U. Adams	940,775
Shoveling machine, W. Whaley	940,997 to 940,999
Sign, R. J. Lackner	940,697
Sign, illuminated, P. Ward	940,847
Signal, A. Hawkins	941,144
Signal and air brake, combined, A. M. Jones	941,259
Silicon carbid, producing, F. J. Tone	941,339
Skins and the like, machine for the treatment of, F. A. Geipel	941,317
Slicing machine, S. L. Garner	940,867
Snap hook, swivel, W. A. Schleicher	940,738
Snow shovel, G. C. Port	941,271
Soap for washing, cleaning, and bleaching purposes, substitute for, P. Mausolff	941,158
Soda fountain, syrup pump for, H. L. Snediker	940,991
Soldering machine, W. M. Holloway	941,147
Soldering tool, automatic, B. F. White	941,218
Sorting machine, A. Picken	941,270
Sound box for sound recording and reproducing machines, J. C. English	940,794
Sound box for sound recording and reproducing machines, J. C. English	940,796
Sound, recording, G. K. Cheney	941,010
Sound recording apparatus, G. K. Cheney	941,011
Sower, seed, S. A. Plummer	940,891
Spades or other tools, means for attaching shafts to, E. C. M. W. Stjernstedt	941,286
Spark arrester, L. A. Coleman	940,955
Spark plug, C. A. Martin	941,157
Speed controller, automatic, W. A. Loomis	940,979
Speedometer, H. C. Berry	941,223
Spindle bands, tension regulating device for, J. S. Berard	941,183
Spring wheel, A. B. Miskin	941,329
Springs, machine for making coiled, F. H. Sleeper	940,828
Sprinkler system alarm, M. G. Young	941,053
Square, S. B. & O. J. Easley	941,313
Squeezer, W. M. Holloway	941,146
Stacker, hay, E. Barnes	940,657
Stacker, hay, F. M. Erwin	941,238

elastic belt placed about the chest is connected with the apparatus, the marking hand will record upon the paper the expansion and contraction due to breathing. Arthur MacDonald, an anthropologist of Washington, has used this instrument in studying the influence of intellectual and emotional states upon breathing and has found that, in general, concentration of thought, as in mathematical calculations or in reading, considerably decreases the breathing. Inasmuch as a falling off of oxygen in the blood results from decrease of respiration he suggests that this may partly explain the proverbial thin-blooded condition of deep students. Prof. Hugo Münsterberg, of Harvard, finds with such an apparatus that sudden pleasure makes the respiration weaker and quicker; displeasure, stronger and slower; excitement, stronger and quicker; acquiescence, weaker and slower. A similar apparatus when attached to the wrist writes a record of the pulse-beats, showing that pleasure heightens and retards them; displeasure weakens and accelerates them; and that excitement strengthens and quickens them.

There is connected to the same recording instrument a device having two rods which press between the lips and transmit a record of their slightest movements to the paper upon the revolving cylinder. Similar gages keep score on the movements of the larynx, soft palate, and tongue, and thus are all of the physical elements of voice measured while various emotions are being experienced.

In one of these laboratories, an instrument when attached to the hand, measures its involuntary movements in three directions—forward and backward, from right to left, or upward and downward; these three elements being recorded upon one revolving cylinder by a separate marking point. Experiments with this device indicate that the hand unconsciously follows the direction taken by the mind. When the subject commences to obey instructions to concentrate his mind on some object, above or below, or to his right or left, the record paper shows that the hand has been moved in the direction of that object. One test used by Prof. Münsterberg is to ask the subject to think attentively of a special letter of the alphabet and then spread in a half circle about the instrument cards bearing these letters. The average subject's hand will quickly record an impulse toward the letter of which he is thinking though he is unaware of it. Thus it will be seen that whither the mind leads the hand will follow unwittingly, and here we have an analysis of gesture and also of the phenomena of "planchette" and "ouija board," as well as of the old-time parlor game of "mind reading"—really muscle reading.

These man-engine gages are revealing many other hitherto hidden truths concerning the mind's unconscious control of the body's movements and actions, and perhaps the prettiest demonstration of this is given by a device consisting of a great tray containing a man lying flat upon his back and balanced upon two knife blades at such a delicacy of poise that the least movement sets the tray to see-sawing. The subject is so placed that his center of gravity rests over the blades and so long as he relaxes his mind and holds his breath a spirit level shows that the tray rests in a horizontal plane; but as soon as he commences to breathe it commences to rock itself in cadence with his inspirations and expirations. When the subject, in response to a command, commences to solve a problem in mental arithmetic the end of the tray toward his head sinks and that holding his feet rises, all of which indicates that when there is any call for special activity of the brain the blood rushes to that organ, as if to nourish thought. But now, if the subject relax his mind as before the tray will again balance horizontally. Next a little device which rapidly revolves two mirror-studded panels is placed before his eyes and may so fatigue

(Continued on page 422.)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES.

WANTED. Manufacturer of enamel ware to manufacture a useful, patented article on royalty basis. Mrs. Sarah W. Hitchcock, 407 E. 3d St., Dixon, Ill.

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Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

FOR SALE. Patent No. 900,457. An improved lathe rest for holding cylinders while being bored in an engine lathe. For further particulars address A. E. Whiting, Weston, W. Va.

Inquiry No. 8996.—Wanted addresses of manufacturers of machinery for working orange wood manicure sticks.

FOR SALE.—Patent No. 901,971. Shock cushioning neck-yoke. Something new, nothing of the kind on the market. Sell outright, reasonable. Address William Kletneschay, Campbellsport, Wisconsin.

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DO you want to manufacture electric heaters? The best patent that ever was issued in the United States is No. 12,742 for sale. Write Moise Landry, Hotel Carolyn, Turlock, Cal.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE.

THE SANBORN BAG LIFTER. A device to assist in handling bags of grain, cement, etc. Saves the fingers and avoids damage to bag. Sample sent free on request. H. & E. Sanborn, Portland, Maine.

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FOR SALE.—Engine lathe, swings 9½ in., takes 25 in. between centers. Complete with full set change gears to cut all size threads, 4 to 40 in. Price only $45.00. Address L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9023.—Wanted, to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

FOR SALE.—An Alvin Clark 4-inch Equatorial Telescope, 5 eye pieces, prism, sun glass and tripod. Cost $325.00. Sherman, 525 East 46th Place, Chicago, Ill.

Inquiry No. 9025.—Wanted, address of rubber manufacturers in Germany.

FOR SALE.—Patent 923,726. Improvement on pipe wrench. Simple in construction and automatic. For full information, write A. C. Pearson, Attorney, 37½ Virginia Avenue, Indianapolis, Ind.

Inquiry No. 9028.—Wanted, to buy a washing machine that is run by a coil spring motor.

TYPEWRITERS.

REAL REMINGTON, $18.75.—One machine only in new localities to secure desirable agent. Special agents prices supplied on all makes of typewriters. 3 ribbons $1.00. Standard Typewriter Exchange, 23 Park Row, New York.

Inquiry No. 9029.—Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

MISCELLANEOUS.

"LIGHT, HEAT, MAGNETISM AND ELECTRICITY are all one and the same thing." If you want to know what they are, send fifty cents for a copy of this pamphlet to A. M. Howland, El Paso, Texas.

Inquiry No. 9034.—For manufacturers of machinery that could reduce stumps to kindling wood.

WANTED.—Designs for a successful single pulley drive for adaptation to machinery tools. Address A. E. Anderson, 79 Dearborn Street, Chicago, Ill.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

HAIR GROWS when our Vacuum Cap is used a few minutes daily. Sent on 60 days' free trial at our expense. No drugs or electricity. Stops falling hair. Cures dandruff. Postal brings illustrated booklet. Modern Vacuum Cap Co., 456 Barclay Block, Denver, Colo.

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

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COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

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A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9043.—Wanted the address of the manufacturers of mirrors that are transparent when the light in the rear is stronger.

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Inquiry No. 9045.—Wanted the address of the International Lumber and Development Co., manufacturers of hardwood.

Inquiry No. 9046.—Wanted, machinery used for the manufacture of all kinds of fruit boxes, baskets and crates.

Inquiry No. 9047.—Wanted, the address of parties who install plants for making oxygen or ozone gas.

Inquiry No. 9048.—Wanted, address of manufacturers of metal table slides for extension tables.

Inquiry No. 9049.—Wanted, to buy rotary brushes suitable for a shoe shining machine.

Inquiry No. 9050.—Wanted, to buy equipment for manufacturing starch and denatured alcohol from potatoes, also manufacturers of equipments for vegetable canneries.

Inquiry No. 9051.—Wanted, to buy machinery for extraction of cotton seed oil on a small scale.

them that sleep will ensue. If so the end of the tray holding his head will rise and that holding his feet will fall, showing that in sleep the blood leaves the brain for the extremities. For a somewhat similar purpose is a large glass jar holding the arm, submerged in water. When any action of the mind causes the blood supply of the arm to increase or decrease—as the vital fluid is attracted toward or repelled by the brain—a marking point resting upon the paper of the moving cylinder above described is raised or lowered. With this has been determined that every emotional excitement speaks in the blood supply of every limb.

How our states of mind unconsciously alter, also our powers of performing muscular work, are nicely demonstrated by a machine attached to the middle finger, generally accepted by physiologists as the index to the body's muscular tone. A vise holds the forearm and hand outstretched, palm upward, upon a table, and the finger is harnessed to a cord hanging over a pulley and suspending a weight. As the finger is bent and straightened it raises and lowers the weight and at the same time a recording point worked by the cord keeps score upon a revolving cylinder. It has been discovered that if the subject concentrates his mind upon the effort of thus contracting his finger frequently and each time raises the weight with his utmost force, his finger will weaken and after a time will scarcely stir the weight. But if he continues to make this effort regardless of the results—without worrying about them—sooner or later the strength of the finger will begin to return and will move the weight almost as much as before. Thus he will continue with alternate periods of fatigue and almost complete recovery—a phenomenon akin to that of the athlete's "second wind." The experiment plainly demonstrates how fear of the results of effort will wear upon the muscles with which the effort is made.

Among the most important of the gages which measure a man-engine's comparative powers of self-direction are those which record the acuteness of the senses—of those telegraph systems over which are dispatched, from the various objects to consciousness, the subtle messages upon which our total impressions of perceived objects are based—the raw material, in fact, out of which our every thought is manufactured.

Acuteness of hearing is tested by a device in which balls of cork fall a certain distance upon a plate of glass, the ear being distant so many inches. At the outset of this test the height from which the balls fall is so slight that the ear does not perceive their impact, but the length of drop is gradually increased until the sound commences to be audible. The acuteness of each ear is measured upon a scale in units of the length of drop at which perception of the sound just barely commences. Then there is a gage measuring the ear's estimate of direction. A graduated horizontal circle surrounds the head and after the subject has been blindfolded a sound is made with a telegraphic sounder moved to the different degrees marked in the circle. The subject's estimates of the direction whence the sound issues are compared with its actual direction.

Acuteness of seeing is measured by devices too numerous for description. One of the most interesting exposes a long black surface across which extend three movable white strips. Two are placed a certain distance apart and the third, moving automatically, is stopped by the subject at the point which he estimates to be exactly between the others. A concealed scale shows his error.

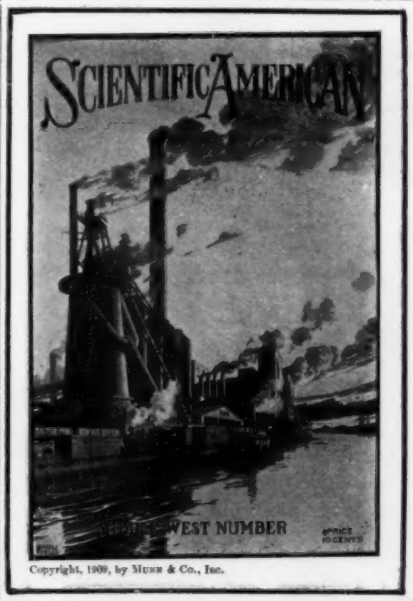
When his acuteness of smell is tested the subject sits before an instrument from which protrude into his nostrils a pair of tubes connecting with a metallic case shielded from his eyes. The examiner fits to the open end of the tubes various cylinders filled with substances of different perfume, whose strength varies

(Concluded on page 423.)

Starch, soluble, A. E. Militz	941,159
Steam or other fluid pressure regulator, W. H. O'Connor	941,092
Steam washer, automatic, R. E. Jack	940,694
Stocking, self-supporting, G. Graham	941,193
Stopper, O. A. Borden	941,302
Stove, Johnson & Noble	941,321
Stove and range top, cooking, B. B. Culver	941,064
Stove frame, gas, F. Graff, Jr.	941,141
Stovepipe, W. W. Graham	940,927
Street indicator and advertising device, combined, J. H. Goodier	940,963
Sweep stock, J. Stone	940,905
Swimming appliance, W. A. Glazier	941,244
Swing, E. Y. Lewis	941,081
Talking machine sound box, J. C. English	940,795
Talking machine stand and horn, combined, H. C. Miller, reissue	13,044
Talking machines, apparatus for making sound records for, C. S. Wickes	941,291
Teaching penmanship, device for, S. B. Smith	940,744
Telephone attachment, C. R. Mitchell	941,086
Telephone cabinet, C. E. Oxford	941,336
Telephone key and means for actuating the same, W. Christensen	940,673
Telephone mouthpiece, antiseptic, G. Rowlands	941,173
Telephone system, D. S. Hulfish	940,693
Telephone system, H. B. Stone	940,746
Telephone system, J. N. Wallace	940,904
Telephonic system for auditoriums, K. M. Turner	941,114
Thorium sulfid, making, J. L. Huber	941,071
Threshing machine concave, O. H. Paschke	941,037
Tie. See Cross tie.	
Tile-faced blocks, machine for molding, Meeker & Drake	940,983
Tin plate by means of chlorin, detinning, H. von Schutz	940,898
Tin plate finishing machine, E. Norton	940,715
Tire, A. T. Tizard	941,289
Tire, cushion, C. O. Baughman	940,919
Tire for vehicles, resilient, G. O. Draper	941,015
Tire protector, rubber, H. R. Palmer, reissue	13,045
Tire, spring, R. M. Spencer	940,904
Tire, wheel, F. L. Berg	941,058
Tobacco press, C. H. Hammond	940,803
Tongue support, W. C. D. Evans	940,960
Tool holder, W. J. Powell	941,272
Tool holder and means for setting the tools therein, M. Morton	940,938
Torpedo, J. Tasto	941,111
Toy, A. H. Cotton	941,314
Track structure, C. W. Kutz	941,324
Trap, C. Janke	940,877
Trap, W. W. Worcester	940,911
Traveling bag hinge, W. J. Petri	941,040
Treadle mechanism, W. Bartholomew	940,659
Trick chair, E. De Moulin	941,135
Trolley pole catcher, J. H. Walker	941,216
Trolley, self-restoring, H. H. Parker	940,718
Trousers crease retainer, H. A. Neumann	940,712
Truck, car, W. H. Son	940,901
Truck, car, C. W. Wodenski	941,293
Truck side frames, brake hanger pin construction for car, G. G. Floyd	940,865
Tubes, apparatus for making spirally wound, C. F. Jenkins	941,255
Tug attachment, shaft, Littman & Lackie	941,326
Turbine, elastic fluid, J. S. Green	940,802
Turbine, elastic fluid, P. J. Hedlund	940,874
Turbine, steam, M. Keller	941,322
Turbines, automatic stop for elastic fluid, F. Hodgkinson	940,680
Typewriter, keywheel, J. W. Miller, Sr.	941,026
Typewriting machine, H. R. White	940,765
Typewriting machine, O. Woodward	941,120
Typewriting machine, C. B. Yaw	941,122
Typewriting machine, J. C. McLaughlin	941,166
Typewriting machine adjusting appliance, C. S. Alverson	941,294
Undertaker's lifting strap, J. P. Huber	941,072
Union suit, J. E. Richards, reissue	13,046
Unloading device, shiftable instantaneous, J. Herks	940,811
Urinal, female, M. M. Van Vechten	940,756
Valve, J. C. Evans	941,314
Valve controlling device, E. T. Pardee	941,033
Valve, cut-off, J. L. Moore	940,815
Valve device for corrosive liquids, W. H. Smith	941,351
Valve gear, Chubb & Mullen	941,189
Valve, rotary discharge, O. Mantius	941,024
Vaporizer, oil, J. F. Malcom	940,981
Vegetable cutter, J. Spenko	940,830
Vegetable cutter, J. Moreau	941,161
Vegetable masher, B. Itsuka	941,073
Vehicle brake, automatic, C. E. Crumm	941,063
Vehicle canopy top, J. Reid	941,274
Vehicle, dumping, W. H. Phillips	940,721
Vehicle, motor, J. A. Charter	941,129
Vehicles, gear actuating mechanism for motor, G. H. Lanchester	941,261
Vehicles, pole attaching means for, J. G. Maloney	940,982
Velocipede, G. C. Worthington	941,121
Vending machine, W. H. Laraway	941,079
Ventilator, J. M. Rose	941,171
Vests, trousers, etc., means for adjusting, F. M. Schmidt	941,277
Veterinary instrument, E. G. Lawton	941,325
Violin key, H. Harmer	941,196
Wagon, camping, D. L. Hardin	941,195
Waist and skirt supporter, A. M. Preston	941,207
Wallet, J. B. Cardwell	940,853
Warp beam tension device, G. Keller	941,201
Washboard attachment, M. G. Sarno	940,896
Washer. See Steam washer.	
Washers, bearing for sterilizing, W. Bartholomew	940,663
Washing machine, Lewis & Graves	940,882
Washing machine, W. E. Devore	941,344
Washing machine attachment, S. Bowman	941,304
Washtub cover, A. Adams	941,054
Watches and clocks, individual hair spring stud index for, C. Teske	940,750
Water bag, F. A. Gordon	941,245
Water closet, etc., tank, G. H. Bailey, 940,951,	940,952
Water closet, ventilating, C. H. Thompson	940,833
Water fountain, B. Kaminsky	940,879
Water heater, D. Haulon	940,685
Water heater, G. C. Madsen	940,980
Water heater, G. H. Wade	941,215
Water power applying apparatus, F. T. Newbery	941,090
Water wheel, D. D. Dennis	940,677
Web folding mechanism, E. Klein	940,933
Wedges, manufacturing compound tapered, C. E. Sweet	940,949
Weeder, F. M. Newland	941,091
Welding tool, W. A. Sparks	940,903
Well strainers, self-closing bottom for, J. A. Pollard	941,205
Well tubing and means for connecting sections thereof, G. A. Pittman	941,204
Wheel guard or fender, vehicle, J. O. Roberts	941,170
Wheels, mud scraper for, J. O. Davison	940,859
Winding, doubling, gassing, and like machine, yarn or thread, Higginson & Arundel	941,319
Winding indicator, J. C. Hawkins	941,143
Window, J. Cooney	941,310
Window construction, metal, G. H. Forsyth	941,018
Wire joints, tool for forming, A. B. Probasco	940,823
Wire stretcher, M. M. Marty	940,884
Work support, W. C. Stewart	940,745
Wrench, W. P. Lewis	940,977
Yeast compound, dry, J. E. Yost	941,221

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.



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The Middle West Number of the SCIENTIFIC AMERICAN

On December 11th, 1909, the Scientific American will issue a number devoted entirely to the wonderful Middle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests of that region, but also those larger engineering undertakings which are destined to transform the Middle West, in part at least, into a manufacturing territory.

With that object in view the Middle West Number will publish articles on the following subjects:

I. The Chicago and Gulf Waterway.—An illustrated description of Chicago's drainage canal, an engineering work which stands without a parallel in the world.

II. Chicago as a Railroad Center.—Chicago is the greatest railroad center in the world.

III. The Wonderful Grain Trade of Chicago.—Chicago is an enormous wheat bin, into which much of the grain raised in the middle West is poured.

IV. Shipping on the Great Lakes.—Most of the iron ore that is now smelted in Pennsylvania is mined in the middle West. To transport it to the blast furnaces of the East at a cost which will enable American steel makers to compete with foreign steel makers, it has been necessary to devise a new kind of lake transportation. Ships of 10,000 and 12,000 tons burden have been constructed which convey ore at small cost through the Great Lakes, and which are without a counterpart anywhere in the world.

V. The Handling and Shipment of Iron Ore.—The above-mentioned fact that iron ore is mined in the middle West and smelted in the East has necessitated not only the construction of special freight-carrying steamers, but also the designing of special machinery for loading and unloading the ore from the steamers.

VI. Freighting on the Mississippi.—Freighting on the Mississippi is a more important industry than most of us may realize.

VII. The Steel Industry.—One of the greatest steel plants in the world is that which has been built at Gary.

VIII. The Freight Subway System of Chicago.—Chicago can boast of a rational system of handling freight by means of subways.

IX. The Water Supply of Chicago.—Chicago's source of water is Lake Michigan. The city is supplied with water by means of a tunnel which extends two miles out into the lake.

X. Reclaiming Arid Lands.—The United States Government has under way many irrigation projects for the purpose of reclaiming lands which are arid, but which will blossom if properly watered.

XI. Harvesting the Grain of the Middle West.—Farms that cover not acres but square miles, crops that aggregate not simply bushels but car-loads, have rendered it necessary to plant and harvest on an unprecedented scale in the middle West. The ingenious agricultural machinery which has been designed to cope with these peculiar conditions is described and illustrated.

The Middle West Number will be more than twice the size of the regular SCIENTIFIC AMERICAN. It will be lavishly illustrated. It will be contained in a colored cover which strikingly depicts Chicago's grain elevators at work. Order from your newsdealer or from

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with the distance to which the cylinders are moved back beyond the tube ends. This distance is marked by a scale upon which is read the point where the subject first perceives the perfume, and thus is the acuteness of each nostril determined.

Taste is measured by solutions of sugar, quinine, tartaric acid, salt, etc., which are more and more diluted with water until the tongue—to which they are applied with a dropper—no longer perceives the flavors; and the weakness of the solution marks the acuteness of the subject's sense of taste.

When testing for acuteness of touch, the examiner holds what appears to be a rimless wheel from whose hub radiate a score of slender spokes. From the free end of each hangs a thread of slenderest cocoon fiber suspending a small disk of elder pith. All of the disks are of equal size and apparently of equal weight, but in reality are surmounted by tiny buttons of metal which give them different weights, varying from one to twenty milligrammes (1/65 to 20/65 of a grain). The subject being blindfolded, the examiner, commencing with the lightest disk, successively lowers one at a time upon the subject's skin. Several of the lighter disks are not felt, but soon there is applied one that is, and the weight of this lightest disk perceived determines the subject's sensitiveness. There are additional devices for measuring the various other elements of feeling, such as perceptions of weight, temperature, pressure, pain, etc.

INDOOR BED TENTS.

(*Concluded from page 416.*)

in the room, and two persons can sleep in the same bed, while only one uses the tent.

This, so far, has been a most successful device for admitting fresh air on sanitary principles to a sleeping room. It enables one to breathe the outside air without danger of being chilled or exposed to drafts and colds. Some who tried this tent felt that the fresh air was too cold in storms or wet weather, and they use an outside awning, which can be adjusted at pleasure. With these tents the body can be kept warm, while the head, which is toughened to the cold, can obtain the stimulation it needs. This last can be modified by a Canton-flannel hood, which can be made so it will come down over the shoulders, and have a face opening large enough to leave the eyes, mouth, and nose exposed. The cape of this hood covers the shoulders if by any accident the bed clothes slip off them.

Fresh air allays sweating, provides good sleep—these tents are capital for insomnia—and helps the appetite. The cold air increases resistance to disease, purifies the blood, and prevents consumption, three reasons why one should breathe it at night. The theory of keeping the head in the cold and the body warm is that the body loses eighty to ninety per cent of its heat through the skin by radiation, and cold is bracing only when it comes in contact with the respiratory organs. On this theory, no good results are obtained when the feet and lower limbs get cold. On a cold night one can move away at least twelve inches from the window and still be under the tent, get perfect circulation, and be sure of getting up in a warm room in the morning.

Not so many years ago Americans as well as foreigners were afraid of the night air, though we have no such malarial districts as around Rome. Fortunately, we are learning to know better, and workers in Little Italy and the slums where foreigners congregate in cities are pushing the fresh-air movement with all their might. Fresh air and plenty of it is the best preventive for consumption, the grip, bronchitis, common colds, and pneumonia. Some sort of inside window tent and paper napkins, tissue paper, or pieces of gauze which are now used by some people for handkerchiefs, are destined to go a long way toward keeping people well, warding off disease and the "Great White Plague."